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COAL AGE

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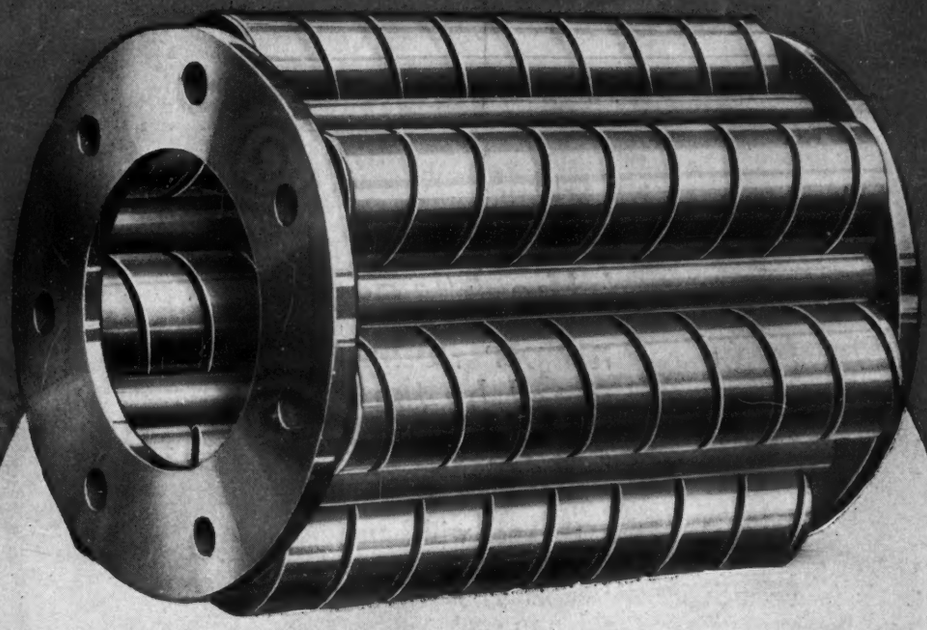

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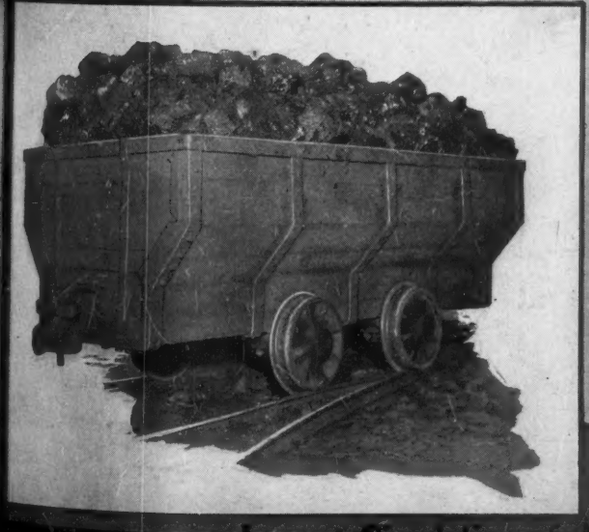

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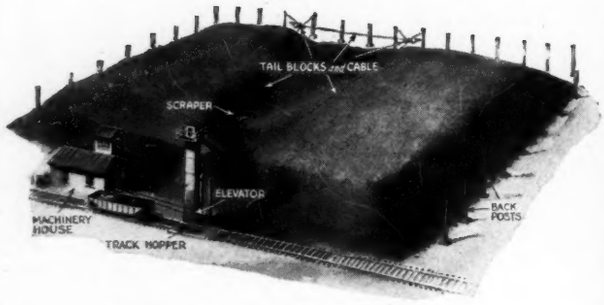
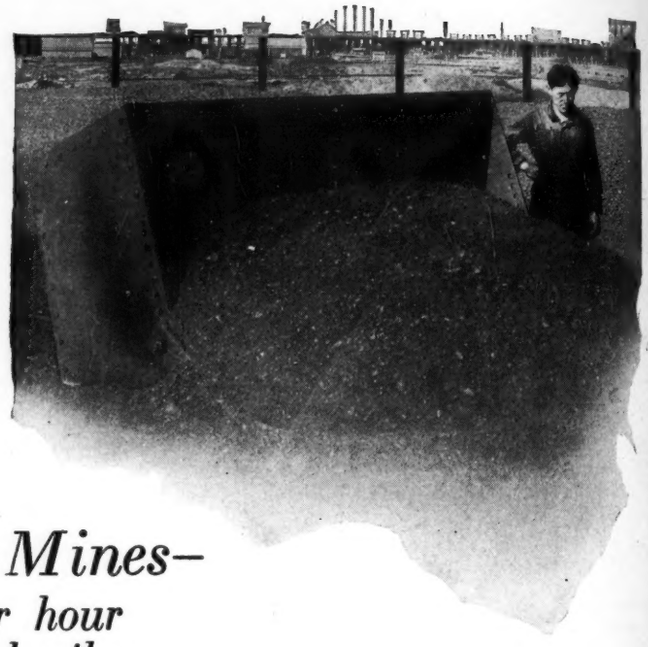


Note extreme simplicity of Beaumont Cable Drag Scraper system for coal storage. Few moving parts—no complicated machinery.



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COAL AGE

The Only National Paper Devoted to Coal Mining and Coal Marketing

C. E. LESHER, *Editor*

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An Opportunity

TIME-HONORED are the complaints of the employer that he has a man of the necessary power to lead and get things done and with ability to think, but that the state perniciously refuses this man a certificate though he knows more than all the "muddled oofs" who have passed the examinations and have certificates of competency.

These complaints have been joined to others. The average employer has men who would make good repairmen—steady, reliable, clever—but not grounded in their art. It is wonderful what they can do, but they lack training.

During these summer months is the time to arrange to get these men the training they need. Provision can be made at some one of the many mining schools in the country, most of which have a short summer course for students who want to be grounded in mining but have not had much scholarship as a basis for collegiate training. The right way to get the minor executive or mechanic sought is to hunt up a man who has all the requisite qualities except technical education and give him such training, be it more or less, as the office he has to fill requires more or less scientific accomplishments.

Easier Not to Mix Than to Unmix

NATURE has segregated more or less satisfactorily coal, bone, clay and slate. Once mixed they are hard to unscramble. Preparation at the tipple or washer is well, but far better is it to take care not to let the impurities get mixed with the coal. Large pieces of slate, it is true, can be removed by picking, but smaller pieces must be separated by washing or on an air table. Even then soft clay from the floor, gathered up by the shovel, can be removed only with difficulty. It cannot be picked, and though washing will remove much of it, a large quantity of fine coal will go with it.

Consequently it would be well not to disturb the clay in undermining or loading the coal. A machine that digs too low will pick up much clay and thus befoul the undercuttings and hence the whole product. Shoveling on steel plates will keep the clay from mixing with the coal, and leaving a little coal in the floor will do the same but will make shoveling less easy.

Drawslate is likely to fall, and sometimes only by prompt propping can it be kept out of the run-of-mine. Sometimes a thin film of coal left in the roof will serve the same purpose. The cuttings, if made in a parting will remove much of the impurity, especially if proper disposition is made of them. If made in clean coal, the product thus obtained may be loaded separately and will give a fuel of extra quality for metallurgical purposes and one that will not need washing. Proper shooting methods also will give a large product well fitted for the picking table.

It would pay any operator to make a careful study of his working faces to see where the impurities are and what means can be taken to provide that they are kept out of the coal, and if removed with it are kept of such size that it is easy in the tipple to separate the clean coal from refuse. An inspector or two in the mine may save a picker or two outside, may make it unnecessary to pay the miner for refuse as if it were clean coal, may enable the operator to obtain a larger and cleaner product and may help in the administration of the mine both as to safety and efficiency.

Electricity and Increased Production

ELECTRICITY is rapidly replacing man, animal and even direct-connected steam power in the coal mines. It is estimated that at the present day there is a total of about 4,370,000 hp. in electrically-operated motors in the coal fields and that this total represents about 48 per cent of the rated horsepower of all types of drivers used.

A remarkable feature of this rapid progress is that it has all been accomplished within the last thirty years. During this period there also has been an increase in coal production of almost 500 per cent and no one will doubt that the application of electricity has been the prime factor in bringing about this high rate of increase in production.

With the advantages of electrical energy so apparent it is not difficult to understand why the industry is turning to its more general use, thus opening up a greater market for all types of electrical equipment and electrically-operated machinery.

The facility and ecenomy with which electrical energy may be transmitted to places which could scarcely be reached by any other method is its paramount advantage. In using hydraulic, steam or pneumatic transmission of energy the losses are unusually high due to unavoidable pipe losses and leakages, while with electrical transmission the losses, even at great distances, are only a few per cent.

A comparatively long transmission system for electricity presents no particular difficulties, and for this reason the location of the generating station may be determined not so much with reference to the point at which the energy is to be used as to where it can be most economically generated. This makes it possible to develop water works for generating electric current, to utilize blast-furnace gases, refuse from coke ovens or low-quality fuels from coal mines. One of these sources of power that formerly was considered a waste product is available in nearly all mining districts; especially is this true in the anthracite field, where it is possible to use old culmbank fuel mixed with the smaller sizes, as the case may require.

In addition to the advantage of utilizing so-called waste products for power purposes, the electric central

station and the attendent centralization of the loads makes the engine load more constant and provides a means of securing the most favorable steam and fuel consumption. This matter of load factor is so important that a recent survey of seven large coal mines, each furnishing its own power—mostly for steam-driven equipment—revealed a total boiler capacity in continuous operation equivalent to twice that necessary to operate a central station of sufficient size to operate the total connected power load electrically.

Such central-station systems are gaining in favor in the coal fields, both in the way of large central power plants for individual coal companies and public-utility companies. At present it is estimated that the total amount of electrical energy used in the coal fields is about equally divided between power plants owned by coal companies and public-utility companies.

Putting It Up to the Fan

WHEN a mining engineer wants to double the length of his trips, all he has to do is to double the weight of his locomotive and double the power of its motors. If his rails and the couplings will stand the load he can readily get the locomotive or use two in tandem. Increasing the tonnage of his trips does not increase his power cost per ton and, as it saves labor, may actually reduce his whole cost for haulage. Besides, if he hauls in one trip what he formerly has hauled in two he removes the possibility of the trips interfering with one another.

He may have to increase the capacity of his feeders and may have to enlarge his central station, if he has one, and increase the size or number of his substations. He may have to pay more for power if he uses so much in hauling his long trip as to heighten the peak load. Barring that last possibility the factor of increase of every item is two or less than two because it may be possible by having longer trips to get some help in overcoming unfavorable grades, for some cars may be on a more satisfactory grade than others, thus helping the locomotive to perform its work. A long trip often is a gradient equalizer.

Operators frequently forget that it is different with a fan. With a given length and size of airway, doubling the volume of the air current means not doubling but multiplying by eight the power of the fan needed, an increase not to be dismissed without careful consideration. It means increasing the leakage of brattices and stoppings, which may make the factor of eight insufficient. It should be remembered that the mine will take only the number of cubic feet that the pressure of the fan acting on the resistance of the roadways will permit to pass through the working. To increase the flow of air the pressure of the fan must be increased.

Consequently the operator, seeing the roadways get longer and longer and in some cases lower and lower as the bottom rises toward the roof due to squeeze and also the airways become more and more cluttered with fallen rock, if it is not removed, will do well to plan carefully when he opens his mine.

He will do well to watch his intake carefully. If it must be a single airway and if he cannot add another later he should make it large, remembering that it has to take an unsplit current. If it is a shaft he should design it not merely to suit the needs of hoisting but with a view to the future requirements for ventilation. He will be well advised if he splits his current as early as possible and avoids curves and offsets as much as he can in such airways as carry the unsplit current. He will watch closely the return, especially where all the various splits have rejoined and are coursing along in one narrow pathway together. The reunited return should be short as is the unsplit intake.

Whatever he does let him not "put it up to the fan maker." He may buy a fan that will deliver enough air and create enough pressure to satisfy his notion, but if his mine will not carry that much air with that pressure the fan will not deliver it. His only hope may be to make a new shaft for the intake or the return or both, or to drive new roadways if the pillars will permit it. Let him remember that the laws of nature are unalterable, and with a badly planned mine a fan will not deliver the required quantity of air except with excessive water gage, and a misuse of power well nigh appalling. He will do well to listen to advice in this respect lest in arguing he find he is trying to combat laws of physics with which none can parley.

Pumping Replaces Ditch Drainage

GRADUALLY the bituminous-coal mines above water level are being worked out. They, like the anthracite mines, are getting deeper year by year. It is true that at most soft-coal mines only one seam is being worked, but such seams are being completely extracted, which is not always the case in the anthracite region.

If we could believe Fayol and the old school of mining men we could feel confidence that the deeper mines would be fed only with "ground water," which when exhausted would be replenished only slowly, but experience shows that the old school is wrong, that the whole area above an extracted coal bed does subside and in subsiding stresses, strains and breaks the rock cover, leaving crevices down which water can percolate more or less freely.

The extraction of one bed, as is the rule in the bituminous-coal region, is not so disturbing as the removal of several, as in the anthracite coal field, but when only one bed is worked the area undermined is greater for any given tonnage, and the water to be handled per ton of coal mined may be little if any less. When the mine is below water level all this water must be pumped. The weakest spots are where the cover is least—that is where the streams are biggest.

For this reason we can look for big influxes of water and an increase in the volume to be pumped. Consequently the pumping load in the soft-coal mine will increase and ultimately it may be no less than in the anthracite region.

Subsidence, therefore, becomes an important problem. How close can an excavation be made to a stream? We are clear that it is not well to mine under it, but it is questionable how near it is well to approach it. In fact the point of approach that will give security against flooding by streams will indicate how far cracking of the surface extends beyond the excavated area.

This is one of the reasons that makes the inquiries of the committee on ground movement of the American Institute of Mining and Metallurgical Engineers so vitally important. To keep down pumping expenses the coal under and near streams should be left intact till the final pillar drawing is commenced, provided the stream is large and the water it carries accordingly is menacing.

Equipment Layout for Washery to Clean Coal as Prelude to Making Metallurgical Coke*

Finding Out What Size Coal Most Needs Cleaning—Three-Quarter Inch Crushing Usually Fine Enough—Equipment Needing Little Screening a Desideratum—How to Avoid Dewatering of Coal—Some Formulas

AS IS IMPLIED in its title, this article will deal strictly with coal that is to be washed for use in the manufacture of metallurgical coke. It now is being generally recognized that the areas in which coal having sufficiently low percentages of ash and sulphur for the manufacture of good metallurgical coke is found are being depleted rapidly, and that, in consequence, coal washing before long will have to receive the attention it deserves from mining, metallurgical and chemical engineers.

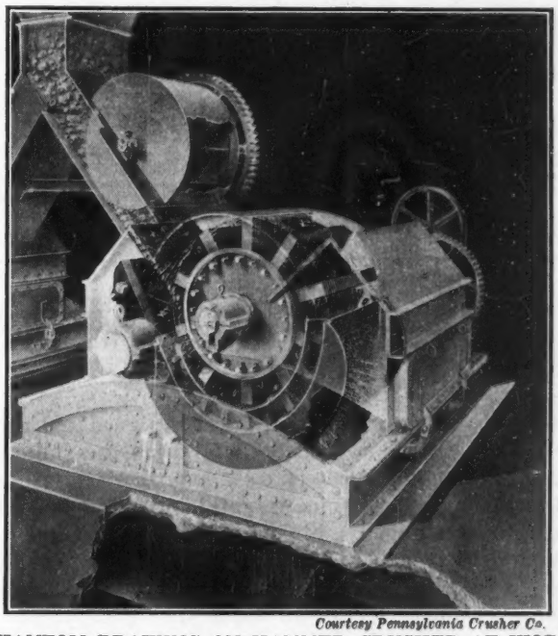
Up to the present time coal washing has been looked upon somewhat as a necessary evil to be avoided like a pestilence, and when coal has been washed at all it has been done only in a half-hearted or desultory manner. Lately, however, the problem has been receiving much attention at meetings of coal-mining men, where it often forms the topic of lively discussions of absorbing interest. Moreover, from time to time, new and improved schemes are being developed that put coal washing on a higher plane than heretofore. It will be the purpose of this article to formulate a general plan, or layout, of coal-cleaning equipment that will enable the prospective owner of a mining plant to install equipment that will clean his particular coal in the most efficient and economical manner.

To illustrate the point a flow sheet (Fig. 1) has been prepared which is intended to cover the subject but in a way permitting of modifications. The different steps and combinations will be discussed in the order of their importance.

Preliminary Investigation.—The importance of a preliminary investigation of the coal to be washed cannot be too strongly emphasized. This has been indicated forcibly by Messrs. Fraser and Yancey, co-investigators at the Engineering Experiment Station of the University of Illinois. It will pay every coal operator who contemplates the installation of coal-washing equipment to read their published opinions on this subject, for they are sound in logic and afford good advice. After all experimental data have been collected, the interpretation of the results is important and should be done only by a competent and level-headed engineer—one who is unprejudiced when it comes to the installation of the proper kind of coal-cleaning equipment.

It probably is a statement of fact to say that the burden of the investigative work is carried out by crushing and screening tests, coupled with the so-called sink-and-float examination and by chemical analysis of the various products. Table I shows the results of such an examination on a certain coal the treatment of which is in need of determination.

On examining the results in the above tabulation it will be noted that the character of the coal is much the same in all the sizes, which makes the cleaning of it difficult. It will be further noted that the sink-and-float tests indicate that the percentage of sulphur in the float coal is nowhere low. This float should correspond with the washed coal.



Courtesy Pennsylvania Crusher Co.

PHANTOM DRAWING ON HAMMER CRUSHER AT WORK

In the upper left-hand corner is the chute, the discharge from which is regulated by a retarding and distributing feeder, the coal passing into the hammers at about the level of the diameter of the axle. The hammer lifts the coal and drives it against the casing. Whatever is friable enough to be thus broken, including all the clean coal, is passed through the screen openings on the underside of the crusher. Whatever is not, whether slate, bone coal or tramp iron, is ejected beyond the screen.

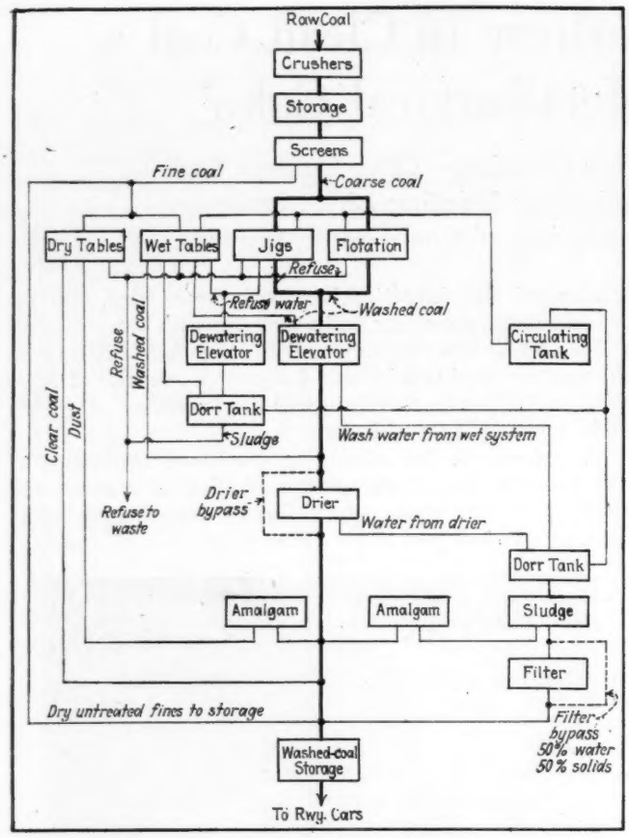
This experimental indication has been borne out in the washing of this coal, but, as the writer has pointed out in a previous article on the subject, the actual sul-

*Contributed.

TABLE I—TESTS AND ANALYSES OF A COAL WITH IMPURITY WELL DISTRIBUTED AMONG SIZES

Screen Sizes		Raw Coal			Float			Sink		
Passes Through	Held on	Percentage of Given Size in Coal Tested	Ash Percentage	Sulphur Percentage	Percentage	Ash Percentage	Sulphur Percentage	Percentage	Ash Percentage	Sulphur Percentage
.....	1 in.	12.09	12.69	3.07	77.22	7.14	2.11	22.78	31.50	6.31
1 in.	½ in.	13.22	13.37	3.91	76.68	6.92	2.21	23.32	34.56	9.50
½ in.	¼ in.	20.09	11.62	3.24	81.71	6.66	2.23	18.29	33.77	7.77
¼ in.	⅛ in.	19.18	11.05	3.41	81.79	5.73	2.20	18.21	34.93	8.83
⅛ in.	¼ in.	14.98	10.88	3.29	81.02	5.08	2.15	18.98	35.60	8.16
¼ in.	10-mesh	2.39	10.35	3.05						
10-mesh	20-mesh	7.03	11.93	3.26						
20-mesh	30-mesh	3.40	13.66	3.19						
30-mesh	40-mesh	1.39	14.05	3.32						
40-mesh	.....	5.30	14.56	3.27						
Loss in manipulation		0.93	.....	.....	.....	.....	.....	.....	.....	.....
Original sample		100.00	12.00	3.34	.....	.....	.....	.....	.....	.....

N.B.—The separation by float-and-sink test of the coal larger than ¼ in. was in a medium of a specific gravity of 1.35.



SUGGESTED FLOW SHEET FOR WASHERY

This illustration is a broad generalization which may be modified to meet the special needs of any given installation. The coal is crushed to ¾ in. diameter. The storage is placed between crushers and screens although it may be conveniently located elsewhere.

phur in the washed coal from a well-designed and properly operated washery will be lower than the sink-and-float tests would indicate. As a matter of fact, also, the percentage of loss in weight in washing is lower, the ash percentage is higher, and the percentage of sulphur lower, than the tests would indicate. To illustrate further the necessity for preliminary investigation, another example is cited in Table II.

TABLE II—TESTS AND ANALYSES OF COAL HAVING MOST OF ITS IMPURITY IN THE COARSE COAL

Constituents	Raw Coal Per Cent
Volatile matter	18.60
Fixed carbon	72.45
Ash	8.95
Total	100.00
Sulphur	0.84

Passes Through	Held on	Percentage of Given Size in Coal Tested	Percentage of Ash
....	1 in.	1.14	44.20
1 in.	½ in.	2.70	29.00
½ in.	¼ in.	4.66	20.96
¼ in.	⅛ in.	7.11	14.38
⅛ in.	¼ in.	7.40	10.72
¼ in.	⅛ in.	19.88	7.93
⅛ in.	.....	57.11	6.48
		100.00	

On referring to the analyses of the screening tests in Table II, it will be noted that the impurities for the most part are found in the larger sizes. In this case it would be unwise and uneconomical for the coal operator to figure on cleaning any size below 8-mesh. This side quite properly may be allowed to bypass the coal-cleaning equipment, and be added untreated to the clean coal. This is readily accomplished by means of screens.

This feature is important in the cleaning of certain kinds of coal, and advantage should be taken of it whenever possible, for it means a big saving in equipment and cost of operation. Care is taken of it in one of the layouts shown on the flow sheet. The same characteristic is not shown in the first example cited, Table I, in which the fines could not be added untreated to the clean coal without a considerable increase in the ash and sulphur contents of the final product.

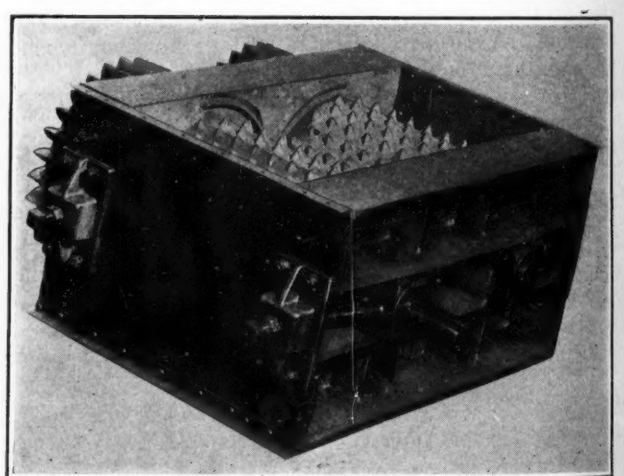
Crushers.—As to crushers the types to be installed will depend largely upon the character of the raw coal and its impurities. Generally speaking, it is found in practice that when the coal is crushed to ¾ in. it will be fine enough to free the impurities for commercial operation. In certain layouts fine crushing is objectionable, as it results in the production of a large percentage of excessively fine coal. In fact it may be said that when the crushing equipment is chosen this possibility should be kept in view. In wet washing it is difficult to handle fines successfully.

Among the types of primary crushers may be mentioned the toothed-roll crushers, the Hammermill and the Ring crushers. Sometimes, as in the making of amalgam, to be described later, ball or rod mills may be used. These are designed to powder coal to 100-mesh and under. If the amalgam method ever has any wide application, these mills, of course, will be more than auxiliary crushers.

Storage.—What storage is provided will be determined largely by the operating conditions. In the flow sheet it is shown as being placed between the crushers and the screens, although it may be located conveniently elsewhere. Under certain conditions it may be even omitted.

Screens.—In a well-regulated coal washery producing coal for the manufacture of metallurgical coke, a screening plant would seem to be absolutely necessary, as higher efficiencies are obtainable when more or less sizing is done. The coal should be screened thoroughly or not at all; otherwise the efficiency of the washery will be much impaired. Where a jig designed for handling coarse coal is used for cleaning a mixture of fine and coarse coal an excessive quantity of good coal, chiefly fines, is almost certain to be lost in the refuse.

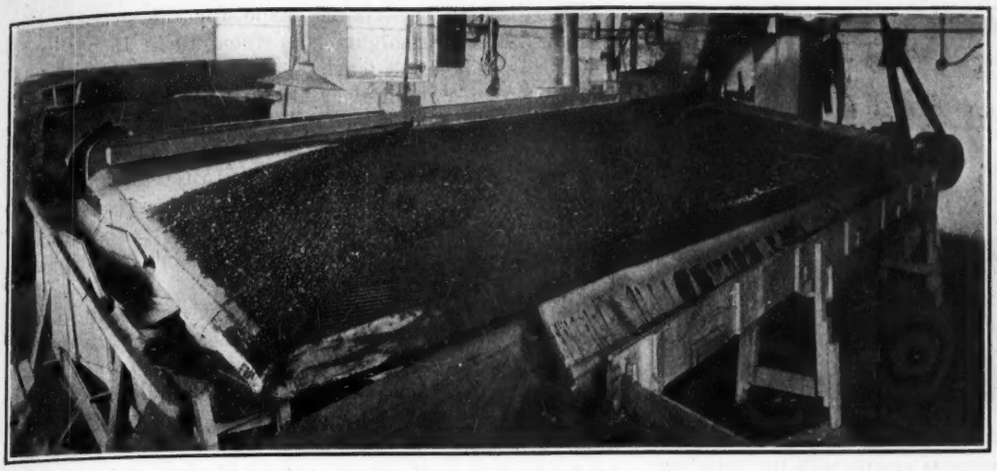
The flow sheet shows two general heads—fine coal and coarse coal. By fine coal is meant coal under ¼ or ⅛ in.



Courtesy C. O. Bartlett & Snow

TWO-ROLL TOOTHED CRUSHERS FOR BREAKING COAL

These crushers are designed to break rather than crush the coal. The action is more like that of a series of picks than that of a steam roller, which latter starts cracks everywhere and makes a powder rather than a granular material. The segments of the rolls can be made of cast-steel, chilled cast-iron, or manganese steel. The crusher measures 26x24 in.



Concentrating Table

The fine coal with the aid of water and the reciprocating motion of the table passes over the riffles and is taken off at the side of the table. The sluggish slate is not so agile in hurdling the riffles, and lands at the end of the table.

Courtesy Deister Concentrator Co.

or thereabouts. Coarse coal is above that and may be conveniently divided into two sizes before going to the jigs or other cleaning equipment.

As to the screens themselves great care should be exercised to select that type which will give the greatest efficiency for a given area of floor space. Apparently the tendency of late has been toward the use of vibrating screens of some sort, although there are efficient screens of the shaker-gravity and anti-gravity types.

Method of Cleaning Coarse Coal.—The flow sheet shows two general methods of handling coarse coal—jigs and flotation. There probably is no better or faster method of cleaning coal than by the use of jigs. No attempt will be made to discuss the merits of the different types of jigs on the market. When tuned up properly, any of them will do fairly efficient work on coarse coal, if the coal is accurately sized. It always seemed to the writer that a single-cell jig was the most logical one to use when at all possible, and in no instance should a jig having more than two compartments be used.

Flotation is shown in the flow sheet as a method of handling coarse coal, as lately at least two methods have been developed for this purpose, and both are being used by a well-known company in the anthracite district. In fact no less than seven flotation plants of one of the two types mentioned have been installed. Sand pulp or a similar material is used for the flotation medium. If flotation can be developed for use on bituminous coals, it appears, at least at first sight, that it would have a rather wide application even to the point of supplanting the use of jigs under certain conditions, on account of the process being faster and more economical. In the light of present knowledge the process seems to imply efficient screening, or the removal of the extremely fine coal and the prevention of abrasion afterwards, because when fines have become mixed with sand pulp they are separated with more or less difficulty.

Method of Handling Fine Coal.—Fine coal, say below ⅛ or ¼ in., may be handled in many ways: (1) Direct or untreated to the washed coal proper; (2) on dry tables; (3) on wet tables. The handling of untreated coal has been described somewhat in detail already.

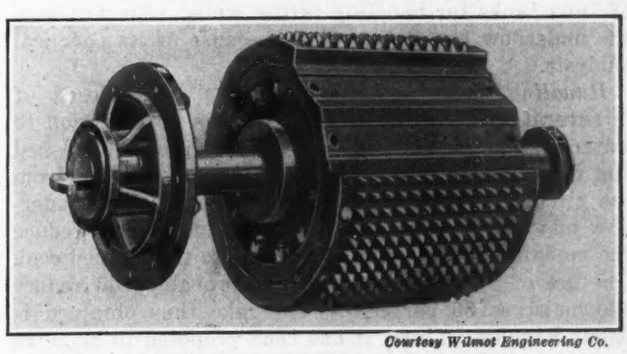
Dry Tables.—Of late coal operators have been giving dry cleaning more than passing attention, as it has many advantages over wet methods, chief of which, when the coal is used in the manufacture of metallurgical coke, is the elimination of water in the washed product. This process not only saves freight on water but helps out at the byproduct oven by a reduction in the coking time. It also has other desirable features. Several dry tables are on the market. Some already have been developed commercially and some are merely in process of development.

One type of dry table requires close sizing. The sponsors for another type assert that it will handle unsized coal below ¼ or ⅛ in. It may be remarked here that in most cases grading in eight or ten sizes is objectionable. It would seem more logical to treat the fine coal unsized, as is the practice on wet concentrating tables. Dry cleaning undoubtedly will play an important part in the coal-cleaning equipment of the future, and it will be to the manufacturer's advantage to develop dry tables that will be as simple as possible and that can be operated with maximum economy.

Wet Tables.—Little need be said about tables of this type, as they are already in successful operation. Like jigs, any of them will do good work when properly adjusted. The choice made will depend largely upon their cost, tonnage and ability to withstand heavy usage.

Dewatering Elevators.—Close attention should be paid to the design of dewatering elevators both for the washed coal and for the refuse, particularly the former. If the perforated buckets are well designed and proper pitch and speed are maintained, they will remove a large quantity of water. In fact if only coarse coal is being handled on the dewatering elevators and if the dry fine coal is added afterward, it is unnecessary to provide any other way of eliminating water. In other words, the centrifugal driers may be bypassed.

Mechanical Driers.—The tendency in coal-washing equipment is to use mechanical driers, or centrifuges, inasmuch as they are comparatively inexpensive to operate, do their work efficiently and occupy little floor space



Courtesy Wilmot Engineering Co.

TOOTHED ROLL WITH TWO SEGMENTS REMOVED

The body of the roll is planed on the surface on which the toothed segments rest. In consequence the tongue-and-groove construction holds the segments securely in place, the only stress on the bolts being that caused by the speed of the periphery.

Courtesy Deister Machine Co.

TWO COAL-WASHING TABLES AND THEIR FEED

The quiet flow of water contrasts greatly with the disturbance in the older types of jig. It is better suited to the fineness of the material with which it has to deal. The table is being agitated along the lines of the ripples. The table feed should be less than ⅛ in. in diameter. Water is added to equal 50 per cent of the weight of the solids, and from 15 to 20 gallons of dressing water per minute are admitted in two boxes or hoods, one immediately in front of the feed box and one about halfway down the side of the table.

as compared with drainage bins. The cost of operation is less than 2c. a ton. There are two well-known types of mechanical driers on the market. Here again the problem is determined largely by the first cost and floor space.

Sludge Recovery.—No matter how careful has been the attention given to the washery layout, particularly the crushing equipment, a certain quantity of fines always will be produced. In this sense the fines are the powdered coal produced by grinding and abrasion; they usually are about 100-mesh material. The percentage varies, depending upon the character of the coal, but usually it is not less than 5 per cent of the input of the washery. In the old days a large part of this fine coal was lost, due to imperfect sludge tanks.

There is no longer much excuse for permitting that loss, if the coal operator is willing to spend the money for an approved method of handling wash water and the sludge from it. As no other type of apparatus is on the market, reference is made in the flow sheet to the Dorr thickener, which serves as a mechanical means of handling the wash water and sludge.

The effluent from these tanks may be so regulated as to contain only a few tenths of one per cent of solids, the quantity averaging probably one quarter of one per cent, consequently it is amply pure for re-use in the washery. The underflow can be thickened down to approximately 50 per cent of solids and 50 per cent of water. Practically the same remarks apply to the use of Dorr tanks for handling refuse water, although here the underflow has to be wasted because of its chemical analysis.

Handling Sludge.—The sludge can be disposed of in several ways: First, where there is no objection to water, it may be pumped directly on top of the washed and dried coarse coal proper, which eliminates it from the circulating system altogether. Second, the underflow may be put through a filter of some kind to reduce the moisture in it before it is added to the washed coal. The use of a drum, or disk, filter probably will reduce the moisture 50 per cent. The cake thus obtained is easily handled. Third, it has been proposed to make an amalgam of the sludge with oil, a process by which, it is asserted, not only the moisture but also the impurities of ash and sulphur are reduced.

According to the claims made for the process, the moisture of the amalgam runs from 10 to 15 per cent, the ash is reduced at least 50 per cent, and the sulphur is lowered to a point near the organic sulphur content of the coal. Furthermore, in the byproduct process the oil is said to be recovered in the form of additional heat value in the gas and in an increase in the tar and motor fuel thus obtained. Although this process is not completely developed, yet in so far as it applies to handling sludge it deserves careful attention and investigation on the part of coal operators.

The same remarks apply in general to making amalgam from the dust of the dry tables, as it has practically the same characteristics as the sludge from the wet washery. In the case of dust, water would have to be added in making the amalgam. In passing it may be remarked that the dust may be recovered from dry tables by means of an exhaust, or blower, system, which seems just as necessary as the Dorr tank in wet concentration.

Mathematical Formulas.—It already has been pointed out that there are formulas based on chemical analyses by which the various problems that arise in coal-washery management can be solved. For instance, in the analysis of the raw coal, washed coal and refuse, the percentage of loss may be calculated even more accurately than by using actual weights. Some of these formulas are as follows:

If H equals the raw coal; W, the washed coal; and R the refuse,

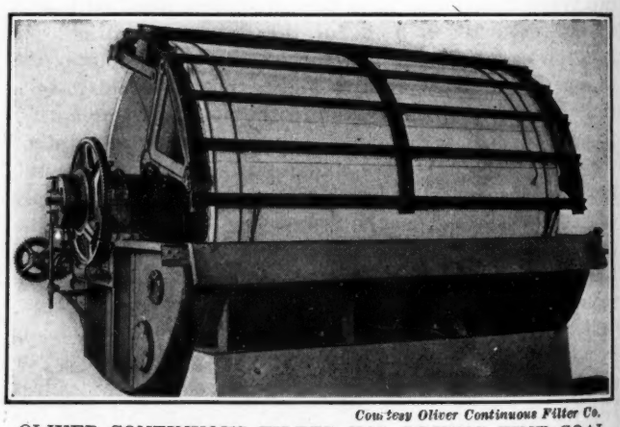
$$\text{Then } \frac{R-W}{H-W} = \text{Ratio of Elimination.}$$

Dividing 100 by this figure gives the percentage of refuse, and of course 100 per cent minus the percentage of refuse = the percentage of washed coal.

In a similar manner

$$\frac{}{(R-W)H} = \text{Percentage of Elimination of Ash or Sulphur.}$$

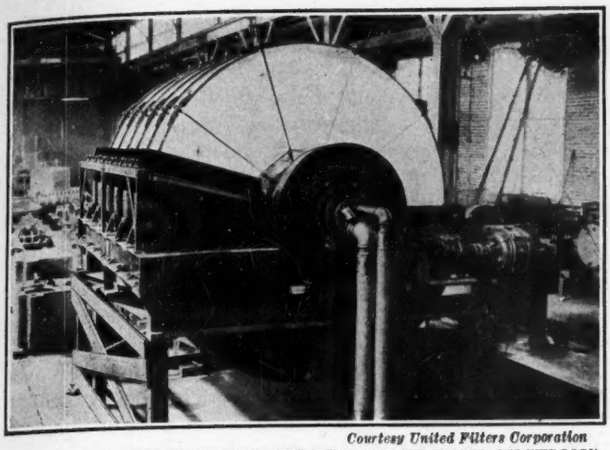
The work of the Dorr tanks may be investigated from the following formulas: If A equals the specific gravity of water; B, that of coal (say 1.35) and X that of the solution under consideration



Courtesy Oliver Continuous Filter Co.

OLIVER CONTINUOUS FILTER FOR DRYING FINE COAL

The filter removes water by sucking the wet coal onto its outer permeable surface and subjecting the layer thus formed to the action of a vacuum within the filter. It consists of a drum or cylinder rotating on a horizontal axis with the lower portion submerged in a tank containing the material to be filtered. The surface of the drum is divided into compartments or sections, the dividing partitions being parallel to the main shaft. These sections are covered with a screen for supporting the filter medium, which is held in place by a wire winding. Each of these sections is connected by means of pipes passing through a hollow trunnion to an automatic valve, which controls not only the application of the vacuum for forming and drying the cake but the admission of air which permits the cake to be scraped loose.



Courtesy United Filters Corporation

AMERICAN CONTINUOUS FILTER WITH DISK SECTIONS

Each section consists of eight to ten separate sectors, each consisting of wood corrugated like a washboard and covered with filter cloth. The shaft is hollow and the moisture in the coal is drawn by the action of this vacuum through the cloth into the corrugations and down these through an orifice in the shaft to the shaft center. By the use of disks a larger area is exposed to the action of the vacuum. The cloth bag on each sector is separate and can be renewed without renewing the covering of other sectors.

Then $\frac{B(X\text{-}A)}{X(B\text{-}A)} \times 100 =$ Percentage of solids in solution.

This formula is particularly valuable in investigating the character of the underflow and, if necessary, the water consumption of the plant, based on the quantity of underflow during any given time.

As to formulas for calculating the efficiency of a coal washery not much can be added to what Messrs. Fraser and Yancey have said in their bulletin on "Interpretation of Coal-Washery Results." These equations are known as the Drakeley formulas, and are given below:

$$\text{Qualitative Efficiency} = \frac{\text{Washed coal float—Raw coal float}}{\text{100—Raw coal float}}$$

$$\text{Quantitative Efficiency} = \frac{\text{Raw coal float—(Refuse float} \times \text{percentage of refuse}}{\text{Raw coal float}}$$

The general efficiency of the washery is considered to be the product of the qualitative and quantitative efficiencies. Objection might be taken to the Drakeley method of obtaining the general efficiency of a washery. For instance, if the washery operator wishes to show a high general efficiency, all that is necessary is to produce a washed coal with only a small percentage of sink in it, which gives him a high qualitative efficiency. But this procedure in all probability would cause an unduly high percentage of good coal to enter the refuse.

G. R. Delamater some years ago published formulas for determining the efficiency of coal washeries which have been subjected to more or less criticism, but after all it seems, according to Messrs. Fraser and Yancey, who have made an exhaustive study into the question, that he was fundamentally right. These authorities have combined the ideas expressed by Drakeley and Delamater into new formulas for showing the general efficiency of a coal washery. These are as follows:

$$\frac{\text{Actual Yield}}{\text{Standard Yield}} \times \frac{\text{Actual ash reduction}}{\text{Standard ash reduction}} \text{ or}$$

$$\frac{\text{Yield of washed coal}}{\text{Yield of float coal}} \times \frac{\text{Raw coal ash—Washed coal ash}}{\text{Raw coal ash—Float coal ash}}$$

Delamater was undoubtedly a pioneer in the literature of coal washeries and in the development of formulas, and as such deserves full credit for his work, even though he made mistakes, as all men will who do original thinking or investigative work.

Applying the principles of Drakeley's formulas, a modern up-to-date coal washery should show a qualitative efficiency of 75 per cent and a quantitative efficiency of 97 or 98 per cent, which will give a general efficiency of 73 or 74 per cent, although Prochaska in his book on "Coal Washing" says 65 per cent may be considered average coal washing practice. He also says that 75 per cent general efficiency is excellent work, but it would appear to the writer that this figure is about what ought to be expected of modern equipment.

Aside from the coal-washing equipment shown in the flow sheet, it may be remarked that there are cases where coal may be cleaned sufficiently by picking tables, picking screens and certain types of revolving screens and disintegrators. These various machines have merit and should be used whenever it is found that they will do the work efficiently.

Ontario and Quebec to Entertain American Institute of Mining Engineers

BEGINNING at Toronto, Aug. 20, and ending at Montreal, Aug. 30, the American Institute of Mining and Metallurgical Engineers will visit several of the mining regions of Ontario while holding its annual fall meeting.

The tentative itinerary contemplates meeting in Toronto and registering on Monday morning, Aug. 20. After a luncheon, entertainment will be offered by Toronto members of the Canadian and American institutes. The party will leave Toronto in the evening on a special train, arriving at Sudbury on the following morning, and will devote the day to visiting the mines of the district, including the Creighton, and the smelting works of the Mond Nickel Co. at Coniston.

Wednesday, Aug. 22, will be devoted to inspecting the mines and mills at Cobalt, and on Aug. 23 the company will be divided into two sections, one going to South Lorrain by automobiles, the other making a boat trip on Lake Timiskaming, visiting the Wright silver mine (Canada's oldest mine) and Ville Marie, one of the oldest Canadian settlements in Ontario.

On Friday the party will be at Kirkland Lake and spend the day in visiting the mines and mills of that district.

On Saturday morning the first stop will be made at Iroquois Falls, where is located the Abitibi Pulp & Power Co.'s plant, one of the largest paper mills in Canada. In the afternoon the party will proceed to Porcupine, where it will be entertained that afternoon and the following day.

On Sunday evening the special train will start toward Quebec over the Canadian National Lines, reaching that city Monday afternoon. While in Quebec the party will be quartered at Château Frontenac.

Tuesday, Aug. 28, will be devoted to technical sessions, the program of which will be announced later. On Wednesday the party will be driven in automobiles to points of interest in and near Quebec, and in the evening a formal dinner will be served, at which short addresses will be given by members of both the Canadian and American institutes. After the dinner the party will return to its sleepers and will reach the Thetford asbestos mines early Thursday morning. The morning will be spent here and at Black Lake, the party taking the train again at noon for Montreal, where a smoker will be held, concluding the program of the meeting.

Bunker and Cargo Coal Destroy Many Ships; Suggestions to Reduce Hazard

THE seriousness of fires on ships due to spontaneous combustion in bunker and cargo coal has led the Department of the Interior to undertake a study of causes and means of prevention, the results of which are given in Technical Paper 326, written by H. H. Stoek and just issued by the U. S. Bureau of Mines, from which source it can be obtained.

A tabulation of casualties from fires on British ships shows that the number of fires caused annually by spontaneous combustion ranges between 50 and 100. The average number of American steamers totally destroyed by fire each year is over 60. In addition, about 140 vessels of miscellaneous types are destroyed, a total of 200 per year. Property losses by fires on ships run into the millions of dollars. The loss of life has been considerable. What portion of these totals should be attributed to coal fires has not been ascertained.

Loss Is Not Limited To Actual Fires

The money losses listed do not include those due to delays in sailing incident to the heating of coal cargoes or to the cost of removing cargoes that have heated. In New York harbor, coal that has heated to 120 deg. frequently is refused for bunker and cargo purposes and other disposal must be made of it. Within the last few years coal handlers in several South American ports have required extra pay for handling coal that has heated.

As a result of its investigations, the Bureau of Mines considers that the danger of loss of life or of a total loss or damage to vessels from coal carried in bunkers or as cargo is sufficient to justify unusual caution in choosing, handling and watching coal placed on ships either for bunker purposes or as cargo.

Undoubtedly certain coals are more liable to spontaneous combustion than others, but the information available at this time does not permit a classification of coal to be made upon this basis. Hence when a choice is possible, a coal that, as shown by its past record, is particularly liable to spontaneous combustion should not be put on a ship. If choice is not possible, and coal with a bad record must be used, it should be carefully stowed and sedulously watched.

Liability to spontaneous combustion is greatly reduced if fine coal and dust be removed by screening, but usually this is not practicable with present coaling methods. Run-of-mine coal generally is furnished to ships, particularly at American ports, both for cargo and bunker purposes. With coal of mixed sizes such as this extra precautions must be taken. If possible, the least friable of the coals available should be chosen, and care should be used in handling the coal in order that breakage and crushing may be reduced to a minimum.

Even Low-Sulphur Coal May Give Trouble

It is wise to select a low-sulphur coal, if possible; but it must not be taken for granted that because of that quality it will be free from spontaneous combustion.

The evidence in regard to the chemical action of moisture in coal in aiding or retarding spontaneous combustion is extremely contradictory. As vessels usually must be coaled promptly, no attention can be paid to weather conditions, and it seems to make little difference as to the tendency to fire whether coal is loaded in wet or in dry weather.

Practice and opinions vary widely in regard to the ventilation of bunkers and holds. Many advocate keeping the coal spaces as nearly airtight as possible by battening down the hatches, but others advocate taking off the hatch covers, when weather conditions permit, to admit air to the surface. Adequate ventilation throughout a coal cargo by pipes or by chimneys built of coarse coal through the pile, as is advocated by some, is impracticable, and it seems better to distribute the coal uniformly and to prevent as far as possible segregation of the sizes, as such segregation tends to produce areas favorable to heating. Moist air circulating through a coal pile seems to cause it to ignite at a lower temperature than it would if the air were dry.

Bunkers and holds should be provided with ventilating funnels to carry off the explosive gases which some coals give off, and great care should be taken in opening a bunker or hold that has been tightly closed to test for explosive gases. In closed spaces where coal is stored, open lights should be prohibited.

Further recommendations of the Bureau of Mines' investigators are as follows: When coal is loaded trim it, if possible, in horizontal layers to avoid separation of the sizes, rather than dump it on a cone and thus permit large lumps to roll to the bottom of the cone and the fine coal to collect near the top of the pile, just under the hatches, where fires are often known to start.

Thoroughly clean out bunkers and holds before fresh coal is put in, and closely inspect coal as it is being loaded, removing from it any waste or pieces of wood, paper, or similar combustible material which may assist spontaneous combustion. The placing of fresh coal on old coal that has been in the bunker for some time is generally considered unwise.

Protect Coal From Boiler Heat

Keep the coal as cool as possible, and avoid placing it in contact with outside sources of heat, such as steam pipes and hot-air ducts. Protect bunkers from the heat of boilers and engines. Take the temperature of the coal at regular intervals, the oftener the better, if there is any tendency to heat. If the temperature reaches 100 deg. F. and is rising rapidly, move the coal to cool it off by contact with air, steam, or, in extreme cases, water. If water is used, burn the coal as soon as possible and keep it separate from the other coal, as the application of water to hot coal breaks it up and by thus exposing fresh surfaces renders it more liable to spontaneous combustion.

Provide an adequate steam supply, hose, pumps and other fire-fighting equipment, and always keep them ready for use. Some automatic fire-detecting apparatus in the pilot house or engine room is advisable.

Provide for the egress, before men enter places where coal is kept, of explosive and other gases that are given off by coal, and avoid open lights in cargo and bunker spaces. Clean the vents leading from bunker or cargo spaces after coal has been put in place.

Clean out thoroughly, when the ship goes out of commission, all spaces where coal has been kept, as fine coal left in corners and on ledges frequently fires. Do not run electric wiring, unless in metal conduits, through spaces in which coal is placed. Use every precaution to prevent sparking at electric contacts.

What Alternating Current Has Done to Increase The Application of Electricity to Mining

Great Flexibility of Alternating-Current Distribution System—Better Voltage and Better Operation—Simplicity of Control, Ease of Repair, Ruggedness of Construction of Alternating-Current Equipment

By Edgar J. Gealy
Electrical Engineer; Associate Editor, *Coal Age*

IN THE earliest coal mines the only form of energy used was human energy, supplied by men, women and children. Later animal, hydraulic, pneumatic and steam energy were added, while today we find included in the list that seemingly all important form of energy called electricity.

Electricity as used in the mines falls into two rather distinct divisions, namely: direct-current and alternating-current. Direct-current, being the more simple form of electricity, was early adapted to coal mining, another important reason for its early use in mining being the fact that direct-current motors better fitted requirements in the mines while alternating-current motors had not been developed to this degree. As long as direct-current was the only form of electrical energy in the mines electrical application was on a moderate scale.

More extensive development of electrical equipment has now placed the alternating-current machine in a position where its application to mining has so many advantages over the direct-current machine that it stands in a fair way to supplant the direct-current machine.

With the sole exception of the haulage locomotive there seems to be no piece of electrical mining equipment which cannot be operated as well on alternating as on direct current.

Economy of Alternating Current

Under the present stress of economic conditions it is imperative that everything be done to increase the tonnage of coal produced per man employed. This means that a greater amount of machinery must be used, and since this machinery evidently is to be driven by electrical equipment we are confronted with the problem of maintaining an ample supply of electrical energy so that each man may be able to get out a good day's work without any reasonably avoidable delay. To accomplish this it is important that the electrical energy be supplied at a voltage that will permit all the equipment to function both efficiently and economically.

With direct current it usually is necessary to limit the range of distribution to one mile for 250 volts and to four miles for 500 volts because this is the economic limit for these potentials. Beyond these distances so much copper would be required as to make the proposition impracticable. We frequently find that these limits are greatly exceeded, however, and it is here that one must realize the importance of that increasingly important subject, engineering economics.

To illustrate the conditions which arise on a long distribution line let us take a case where the voltage between trolley and rail is to be determined in a 250-volt mine using 4-0 copper trolley wire and a single 4-0 solid copper feeder in parallel, the voltage to be determined at a point 3,000 ft. from the direct-current generator and the current to be assumed at 500 amperes. Under these conditions the voltage drop would be 70, thus leaving only 180 volts between trolley and track at the point mentioned.

Standard electric motors are designed to operate satisfactorily at 10 per cent under voltage or 10 per cent over voltage. Obviously even with the large trolley and feeder in the above example the resultant voltage remaining is far too low to give satisfactory operation.

From the fundamental laws governing the drop of voltage in conductors we may draw two important conclusions: (1) With the amount of power to be transmitted and the distance fixed, if the loss is to be cut in two, the wire will have to be doubled with a given voltage; (2) if the percentage of loss is to remain constant and the voltage is doubled, the wire may be cut in four—that is, actually reduced to twenty-five per cent in size.

Advantages of High-Voltage Distribution

Obviously high voltage is one of the greatest boons to electrical transmission. With a direct-current system the only feasible means of changing the voltage either up or down is by the use of a motor-generator set that is expensive, relatively inefficient and also requires more or less attention. With an alternating-current system the voltage may very readily be either raised or lowered by means of a transformer, a piece of electrical equipment which operates at high efficiencies and with little or no attention.

From this it is evident that the direct-current system is limited to those installations where all the energy is to be used within a relatively short distance of the power plant, whereas the alternating-current system lends itself to an almost unlimited distance for distribution. As the workings of the mines are extended and it becomes increasingly more difficult to keep up the voltage at the face the alternating-current distribution system increases in importance and economy.

Frequently a new mine is opened and developments at first are carried on in a small way with direct-current used for the distribution of electrical energy. If the mine succeeds this is almost invariably found to be a mistake because as the operations become more extensive in both distance and electrical needs, greater capacity is demanded in the equipment for converting alternating current to direct current or better voltage is needed at the face, which will require increase in voltage or extensive layouts in copper feeders.

Aside from the advantage gained by the use of smaller conductors used on alternating-current systems we have the added advantage of greater flexibility with the use of alternating current.

Transformers may be installed in almost any part of

the mine and, where necessary, they may be enclosed in fireproof concrete vaults, making the possibility of damage from fire very remote. The locating of the transformers near the place where the energy is to be used makes possible the transmission of almost any conceivable amount of available capacity. With the alternating-current system it is a very simple matter to extend the system at any time, stepping up the voltage when necessary to get to any remote point.

Under the present high stage of development of the alternating-current induction motor its application to various forms of drives has been markedly successful. The three-phase motor is most generally used and depending upon the frequency and number of poles in the stator winding practically any desired speed may be obtained without any additional control equipment outside of a starter. These advantages make it possible to apply the induction motor to a large number of applications and greatly simplifies the gearing system, in fact, the gearing may be entirely eliminated in many cases.

The squirrel-cage induction motor has been extensively applied to pumps and fans with conspicuous success, maintaining almost constant speed under wide variations in load. Here the ruggedness of the motor has proved itself, it having no commutator, but instead a simple rotor winding and a simple stator winding it is little affected by the mine humidity or splashing of water from the pump or fan. Another advantage is the relative ease with which a temporary repair can be made when a coil or coils in the stator break down; in this event it is rarely necessary to do more than "cut-out" the bad coil or coils by making a reconnection on the ends of the winding, which are easily available. Frequently important motors have been successfully operated for days and weeks with as much as 15 per cent of the winding "cut-out" until repair parts were received and the repair made.

We therefore find that the use of alternating current enables the engineer to maintain better voltage for all equipment, renders the energy distribution system more flexible, effects greater simplicity, lessens the need for repairs, affords larger assortment of equipment at lower cost and better deliveries.

Engineers, Scientists and Editors Plan Uniform Symbols and Abbreviations

A RECENT meeting held in New York City under the auspices of the American Engineering Standards Committee to further discuss the desirability of and procedure to be followed in establishing a unification of technical and scientific abbreviations and symbols was attended by a large and representative group of engineers, scientists, government officials, business-paper editors and industrial executives.

It was agreed that the standardization would result in inestimable mental economies, as the present situation with respect to the use of scientific abbreviations is comparable to a language that has degenerated into a multiplicity of dialects.

Abbreviations and symbols constitute an ever growing and important part of the language of the sciences. The use of one symbol or abbreviation for several different terms or meanings and the use of several different symbols or abbreviations for one meaning at present cause much confusion and often serious errors.

The conference was originally called by a limited group of engineering societies but after some discussion of the subject it was thought desirable to include as a part of the project the graphical symbols which are used in engineering drawings, diagrams, and the like, for representing instruments and apparatus and components of them. Here, it was thought advisable to obtain the co-operation of foreign standardization bodies in the work on account of the international character of much engineering and scientific work.

The work will go forward under a committee organization in accordance with the rules and procedure of the American Engineering Standards Committee.

Submits Tentative Standardization of Anthracite Names and Sizes

The Subcommittee on Standardization of Anthracite Sizes of the American Society for Testing Materials has prepared a tentative schedule of names, sizes and screen specifications for testing anthracite.

The following is a list of the names and sizes now used or used in the past:

ANTHRACITE SIZES, IN INCHES

	Round		Square						
	Through	Over	Through	Over	Slate, Per Cent	Bone, Per Cent	Total, Per Cent	Large, Per Cent	Small, Per Cent
Lump (Steamboat)	7	4½	6½	4	..	..	..	5	10
Broken (Furnace)	4½	3½	4	2½	1	2	3	5–9	5–10
Egg	3½	2½	2½	2	2	2	4	5	10
	3	2½	..	..	..	..	..	....	None
	..	2	..	..	..	..	..	....	.....
Stove	2½	1½	2	1½	4	3	7	5	10
	2½	1½	..	..	..	.	..	....	None
	2	1½	..	..	..	..	..	....	.....
Chestnut (Nut)	1½	¾	1½	¾	5	5	10	5	15
	1½	¾	..	..	..	..	..	....	.....
	1½	..	..	..	..	..	..	....	.....
	1¼	..	..	..	..	..	..	....	.....
Pea	¾	⅜	¾	⅜	10	10	10	5	20
	¾	⅜	..	..	..	..	..	....	.....
	..	⅜	..	..	..	..	..	....	.....
Buckwheat	⅜	⅜	⅜	⅜	15	15	15	...	15
	⅜	⅜	..	..	..	..	..	....	.....
	⅜	..	..	..	..	..	..	....	.....
Rice (Buck. No. 2)	⅜	⅜	⅜	⅜	..	..	..	....	15
Barley (Buck. No. 3)	⅜	⅜	..	..	..	..	..	....	.....
		⅜	..	..	..	..	..	....	.....
Birdseye (Boiler)	⅜	⅜	..	..	..	..	..	....	.....
Culm (Slush)	⅜	⅜	..	..	..	..	..	....	.....

These are the sizes recommended by the subcommittee:

	Round-Hole Screens Through	Over		Round-Hole Screens Through	Over
Steamboat	7	4½	Pea	¾	⅜
Broken	4½	3½	Buckwheat	⅜	⅜
Egg	3½	2½	Rice	⅜	⅜
Stove	2½	1½	Barley	⅜	⅜ or ⅛
Chestnut	1½	¾			

Class 1 Railroads Consume 9,451,000 Tons Of Coal in February at $3.72 per Ton

Class 1 railroads of the United States consumed 9,451,000 net tons of coal during February, 1923, as charged to account 394, compared with 10,358,000 tons during the preceding month and 7,842,000 tons in February, 1922, according to a recent report of the Bureau of Statistics of the Interstate Commerce Commission covering 176 steam roads. During the first two months of 1923 these roads consumed 19,810,000 tons as compared with 15,968,000 tons during the corresponding period of 1922. The delivered cost per ton in February last was $3.72 compared with $3.55 for the corresponding month of last year.

Consumption of fuel oil during February totaled 135,537,000 gallons compared with 150,317,000 gallons in January and 110,679,000 gallons in February, 1922. The totals for the first two months of 1923 and of 1922 were 285,850,000 and 234,526,000 gallons respectively.

Handling and Testing Armatures

Careful Packing Especially Essential—Handling at Mines Should Be Done with Due Consideration of Dangers—Testing on Receipt of Armature Will Avert Considerable Annoyance and Expense—Methods of Making Tests

ALL reputable manufacturers and repair shops where armatures are either built or repaired have a regular system of testing them during the process of manufacture or repair and also upon completion. This is especially necessary with equipment used about the coal mines because of the severe conditions under which the armatures must work and the expense and inconvenience occasioned whenever one of them breaks down or must be taken out of a motor for any reason.

The reliability of such tests depends upon the persons conducting the test. For the most part these testers have become very proficient, due in part to the elaborate system of checking back upon any particular tester in case any equipment leaves the shops and is reported defective upon arrival at its destination.

There are so many important points to be considered in the handling of an armature around the coal mines that we shall single out only a few and give them our consideration.

Proper connections and insulation are the most important features in connection with all electrical equipment from the standpoint of maintenance.

The most delicate parts of a direct-current armature are the commutator and the coil ends, or turns. When lifting an armature special care should be taken of these parts and it is advisable to use a lifting band or sling whenever possible. A lifting band should be made of

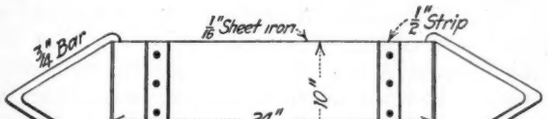


FIG. 1—LIFTING BAND FOR ARMATURES

The band is used around the body of the armature, thus forming a sort of hammock for carrying the armature instead of sliding or rolling it and causing damage to the winding.

sheet iron sufficiently flexible to be placed around the body of the armature as shown in Fig. 1. Such a lifting band is fitted with handles of sufficient strength to carry any weight to which the band may be subjected when lifting the heaviest armature.

If a sling is used it should be placed over each end of the armature shaft and a brace placed so as to prevent the rope from crowding against the commutator or coil turns, as shown in Fig. 2.

Great care should be exercised whenever an armature is boxed for shipment. Improper boxing of an armature being sent away for repairs has frequently increased the damage to the armature and necessarily the expense of the repair work which must be done.

The armature box used for shipping should be so constructed that the armature will be supported by its shaft, regardless of the position into which the box may be tipped during shipment. When the armature shaft is short and does not extend far enough outside the ends of the commutator bars, it can be extended by a short piece of pipe slipped over the end of the shaft. Care should be taken here to block the end of the pipe so that it cannot shift and thus allow the armature to drop.

To fasten the lid on the box it is always preferable to use screws, as their use gives the box greater strength, and they are more likely to be properly placed so as not to damage the armature. If nails or screws are used in the construction of the box, great care should be exercised so that they do not injure the winding on the commutator.

When moving armatures about the colliery, they should never be rolled, as such a procedure, although too common, aside from forcing particles of dirt, coal, metals or other foreign materials into the coils, also strains the laminated core, which shifts and chafes or cuts the insulation of the coils in the slots of the armature. The proper way is to support the armature shaft in a kind of cradle (as shown in Fig. 3), similar to a stretcher with two handles at each end. The armature should be further protected against moisture and mechanical injury from falling objects.

When a new or repaired armature is received, it should be unpacked at once and given a careful inspection and a thorough test. In some instances such a procedure discloses a fault which, if found in time, will not only prevent more serious damage but will also save the work and inconvenience of assembling an armature in a motor only to find it defective.

One of the first things to be done with a new or repaired armature is to look it over very carefully for any outward appearances of damage or wrong assembly. This inspection consists in examining the coils, which should not be broken, improperly insulated, or not well down in position. The commutator should be examined for high, low or rough spots, or short-circuited bars. The clearance of the coils when the housings are in place should be examined, and the shaft and bearings should be examined for a true fit. After this is done the armature should be tested for electrical faults. A test should be made for grounds in the coils or commutator, for short-circuits in the coils or commutator and for open circuits in the winding. The equipment necessary for the above-mentioned tests consist, in their simplest form, of a telephone receiver, a buzzer, a battery and a few pieces of wire. All colliery electricians should supply themselves with this simple testing set for any emergency. Let us assume we are going to test an

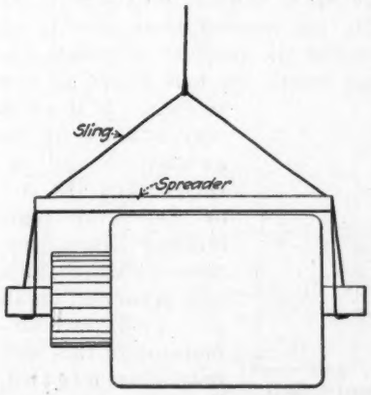


FIG. 2—ARRANGEMENT FOR SLING

The sling is kept from crowding into the commutator and coils by means of a brace. Frequently considerable damage is done by careless use of chains and ropes used as slings.

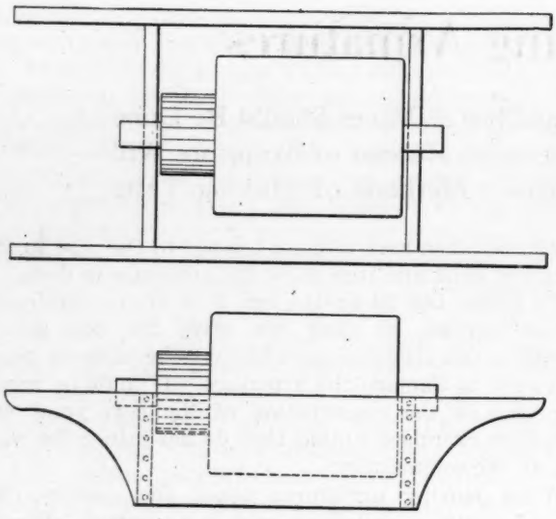


FIG. 3—ARMATURE CARRYING BOX

An unnecessary expense in repairs to armatures can be avoided by furnishing a supply of boxes similar to the above. These boxes can be used to transport armatures to all parts of the mines with reasonable safety.

armature for an open-circuited coil. This test is essentially the same as the test for a short-circuit coil. First of all we will connect a buzzer and battery in series as shown in Fig. 4; the free terminal of the buzzer and the free terminals of the battery are placed on the commutator say about 10 to 15 bars apart on the average commutator. As soon as this is done the buzzer will start to vibrate because the circuit is now closed through the winding on the armature; next the two terminals of a telephone receiver are put on two adjacent commutator bars about half way between the two terminals of the buzzer circuit. If the coil connected to the two bars to which the telephone receiver is connected is all right there will be only a slight vibrating sound in the receiver, because the receiver is shunted on the coil. If there is a loud sound in the receiver then there is an open circuit in the coil and the receiver terminals are not shunted by the coil, hence the loud sound in the receiver. If there is very little or no sound in the receiver then the coil or the two commutator bars are short-circuited. This test is carried on all around the commutator in this way until completed, always keeping the receiver terminals about half way between the buzzer circuit terminals as all four terminals are moved around the commutator during the test. If an open circuit is found it will be well first to examine the connections to the commutator bars, as the trouble may be there; otherwise the trouble will be found to be in the coil. If a short-circuit is found examine the commutator bars and see if the bars are short-circuited, especially at the necks of bars and at the mica between the bars. If necessary disconnect the coil from the commutator bars and test to find out whether the short-circuit is in the coil or in the bars.

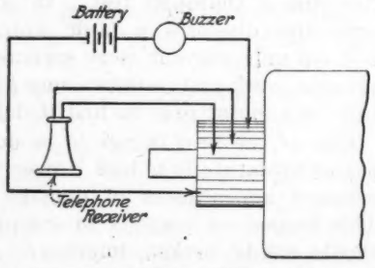


FIG. 4—TESTING FOR OPEN- OR SHORT-CIRCUITS

The bar-to-bar test will readily locate defects. Sometimes it will be necessary to disconnect the coils from the bars to localize the trouble.

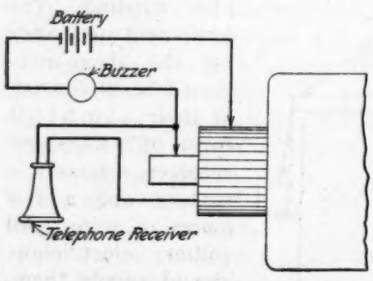


FIG. 5—TEST FOR GROUNDED COILS OR BARS

Grounds usually are easily detected, but sometimes difficult to localize. A little experience with this outfit will enable the operator to localize the ground by the variations of the sound in the receiver.

Fig. 5 shows the arrangement for testing the armature for grounds. Here the battery terminal is moved around the armature and when it comes to a grounded bar or coil the sound in the receiver stops or becomes very weak. In this way the grounded bar or coil can be located, and here again it is advisable to disconnect the coil from the bar so as to determine whether the ground is in the bar or the coil.

Would Organize Syndicate to Buy Cars and Apportion on Basis of Consumption

IN ANSWER to a question addressed to L. S. Evans, president of the Eastern Coal & Export Corporation, prompted by his article on ownership of coal cars (*Coal Age*, April 19, 1923), he has written the following comment:

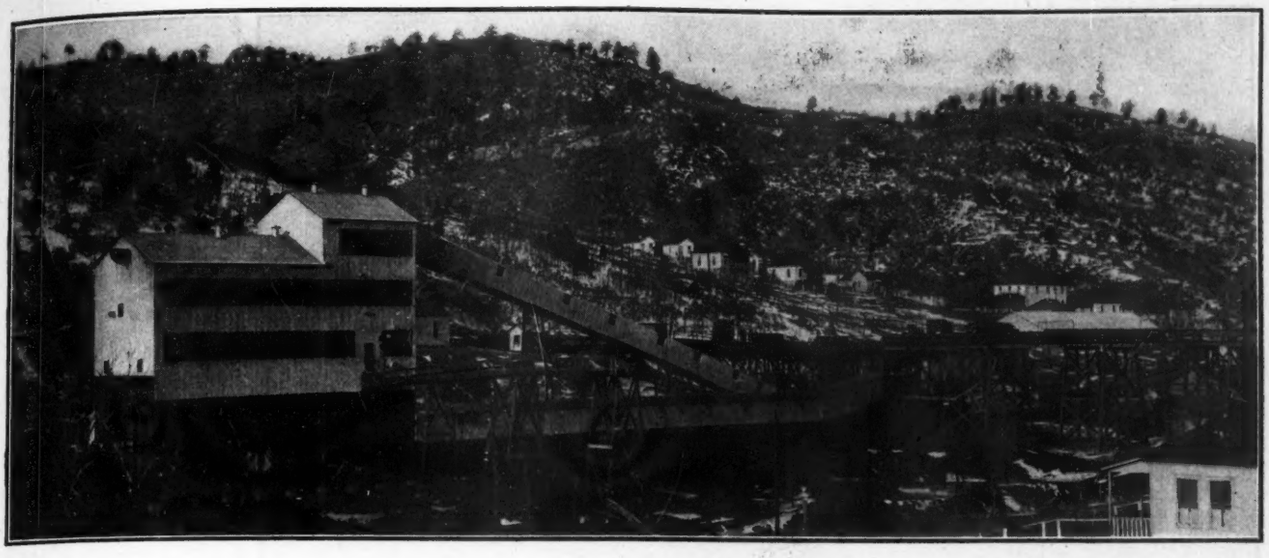
"In reply to your letter of April 19, I am sure you are correct in saying that non-originating roads would not favor owning coal cars, and I do not blame them. So long as they can put this burden on the coal roads and collect revenue on coal tonnage carried in the other man's cars, they will be opposed to any plan having for its object the shifting of the financial burden to their own shoulders. The point is not the attitude of the roads, but the essence of the question is whether consumption or production is dominant.

"We have gradually come to view the railroads as facilities to give service to the public, rather than business enterprises promoted to pay dividends to investors. In consequence we have the Interstate Commerce Commission controlling the roads, with the public interest uppermost in their minds. On the other hand, purchasing of cars is left to the different roads, and is, therefore, made by and subject to the viewjoint of their owners. I mean that the railroads buy cars only when the pressure of necessity compels their purchase, and such pressure always comes after the needs of the public have exceeded the facilities of the roads.

"A way around a sudden reversal of the present practice would be the formation of a national car-owning company, contributed to by all the roads, which corporation or syndicate would buy coal cars as a pool and distribute them to the different roads on the basis of coal consumption thereon.

"The opposition of non-originating roads is in itself not an argument against the idea, and the point is to arouse discussion and have the opposing roads state valid reasons and facts to support their point of view. Something must be done in this country to remedy the defects in coal distribution, or the uninformed public, in conjunction with the ignorant labor unions, in the mass will bring about nationalization or some other form of socialistic control."

EVIDENTLY THOSE VICTIMS of that Herrin mob committed suicide.—*Greenville Piedmont.*



Screening, Dry Cleaning, Aspirating and Dust Collecting At Brilliant Mine in New Mexico*

Coal Under One-Inch Diameter Sized on Two Banks Each Consisting of Five Ascending Screens — Oversize Cleaned on Two Spirals — Coal Under One-Sixteenth Inch Aspirated—Minor Mechanical Difficulties in Operation

BY F. A. YOUNG
Chief Engineer, St. Louis, Rocky Mountain & Pacific Co., Raton, N. M.

ORIGINAL in most of its features is the dry-process cleaning plant built and operated by the St. Louis, Rocky Mountain & Pacific Co. adjacent to its mine at Brilliant, N. M. The equipment consists, primarily of screens for separating the coal into five different sizes all smaller than 1 in., an aspirator for preparing a sixth size and pneumatic machines each cleaning one of the six sizes. These machines are patented and were manufactured by Sutton, Steele & Steele, of Dallas, Texas., until a few months ago, when all the selling rights were acquired by the American Coal Cleaning Corporation.

These screens (see Fig. 1) are called anti-gravity screens because the coal travels uphill. The screens at Brilliant are 3 ft. wide and 7 ft. 4 in. long. They consist of one upper deck having a screen of wire mesh which slopes upward at an angle of 12 deg. in the direction in which the coal flows. Under this is a lower deck sloping in the same direction at an angle of 7 deg. and having a solid bottom. This deck advances the undersize to the next screen.

These decks are about 11 in. apart at the discharge end. Owing to the pitch in the lower deck and the fact that the undersize is carried upward it is possible to place any number of screens on a level floor, the coal from one screen falling a few inches onto the upper deck of the screen next in line. This is one of the most valuable features in this arrangement, for the coal does not have to be elevated or rehandled in any way.

The oversize may be taken off on either one or on both sides. The length of the screens corresponds to the proper spacing of the cleaning tables, which obviously are placed on the floor below. I know of no other screen which can be operated in this way. The coal is caused to travel by a reciprocating motion, a shaft with two eccentrics, one on each side of the screen, being placed under the screen at about its midlength.

The screen box is attached to the stationary underframe by means of cast-iron plates extending across its full width. These are placed at an angle, as shown, so that the forward motion of the eccentrics causes the screen box to rise as it moves forward and the backward motion drops the screen from under the coal, thereby causing it to advance. The coal, advancing over the screen cloth in this rolling or jumping motion, is sized most effectually. It should be stated here that accurate sizing is necessary for the success of the cleaning tables. The stroke of the eccentric is 1 in. and the speed 350 r.p.m.

The pneumatic cleaning table works on the principle that when a film of coal 1 to 2 in. thick, the individual pieces of which are nearly all of the same size, is placed on a flat perforated surface and a large volume of air passed through it, the lighter particles, which are the clean coal, soon find their way to the top of the film, whereas the heavier particles, or waste, remain on the bottom.

The machine is built with a perforated deck about 4 ft. square under which is an air chamber and air duct connecting with a fan which is part of the machine.

*Article entitled "Dry Cleaning Coal at Brilliant Mine," read before Rocky Mountain Coal Mining Institute Feb. 27, 1923.

NOTE—Headpiece shows dry-process coal-cleaning plant at Brilliant Mine, the trestle from the mines and the tipple. Note the conveyor shed by which the cleaned coal is returned by a belt conveyor to the tipple for mixing with the run-of-mine if desired. The cleaned coal also can be delivered from a storage bin to cars spotted at proper points alongside the building.

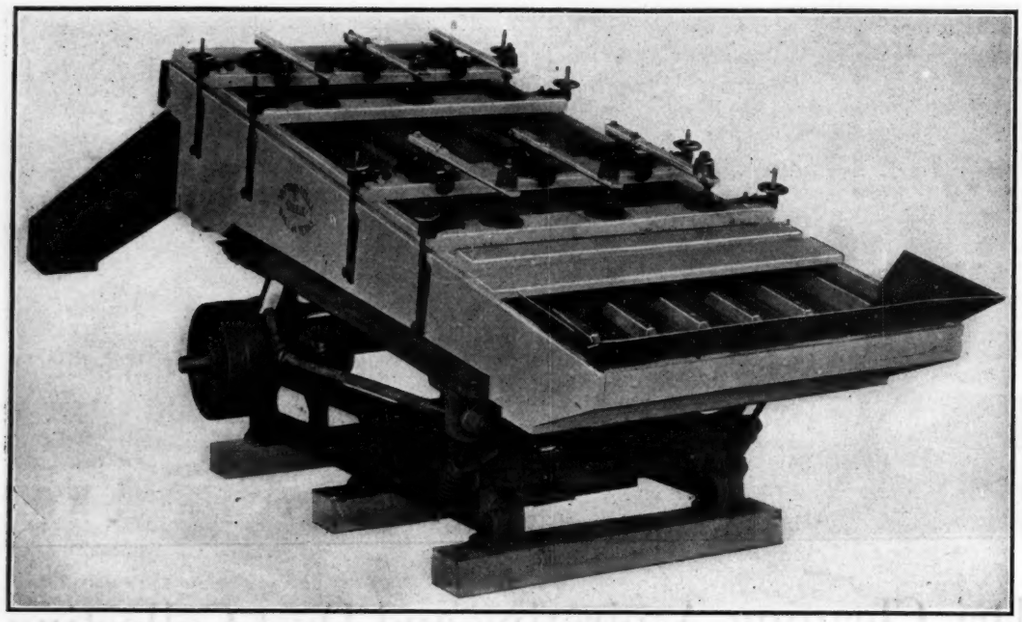


FIG. 1

Screening Table

The lower or feed end of the table is provided with a guard plate so that the air will not be sucked in by the dust hood except from over the screen. The eccentric will be noted by which the screen is shaken in strokes of one inch amplitude. The eccentric shaft makes about 350 r.p.m., the number being variable at will.

The deck of the table has a reciprocating motion the same as that of the screens already described. This tends to advance the product up a slight adjustable slope. The coal is fed at one corner of the table as shown, and the deck slopes away from the feed and at right angles to the reciprocating motion. On top of the perforated deck are riffles about 2 in. apart, running parallel to the line of reciprocation. These riffles are about ½ in. high at the fan and feed side of the table and taper to nothing at the far side.

When coal is fed onto the table, the air passing through the perforations tends to raise it and roll it over these riffles down the slope toward the clean-coal discharge. The heavier particles do not get over the riffles as rapidly as the lighter ones, and the reciprocating motion is constantly pushing them toward the far side, where the waste is discharged. With these two actions constantly at work and tending in directions at right angles to each other and with the slopes in two directions nicely adjusted, a line is formed in a few minutes between the coal and the heavier particles, the line being near that side of the table which is opposite the fan.

A splitter board is readily adjustable along the discharge side. This deflects the coal into one spout and the waste into another. As this separation is rapid some particles are sure to fail to arrive on time at their proper position. For this reason it is advisable to make a third product, middlings, and this product is taken back and sent through the entire process for a second trial.

As this method of cleaning depends for its success on the difference of specific gravity between the coal and the impurity, it will of course work better when the refuse is slate or rock than when it is bone. There is, however, another important factor. Not only must the pieces treated be all of the same size but also all of the same shape. A slate impurity is sometimes thin and flaky, and in that case it is difficult to separate.

At our Brilliant mine the impurity is nearly all slate, some of it in thin flakes. At our Koehler mine the impurity is mostly bone. This material breaks into pieces of the same shape as the coal. In a full day's test run on Koehler coal we were surprised to find that it was cleaned even more effectually than that from the Brilliant mine.

This latter mine produces about 800 tons in 8 hours. Our intention was to clean in this plant such coal as would pass through a 1½-in. bar screen. This appeared by test to be about 75 per cent of the total output. It was known that these screenings would contain many thin, flat pieces much larger than 1½ in. Consequently, in order to exclude pieces larger than that size, it was decided that it was best to treat 1 in. and smaller on

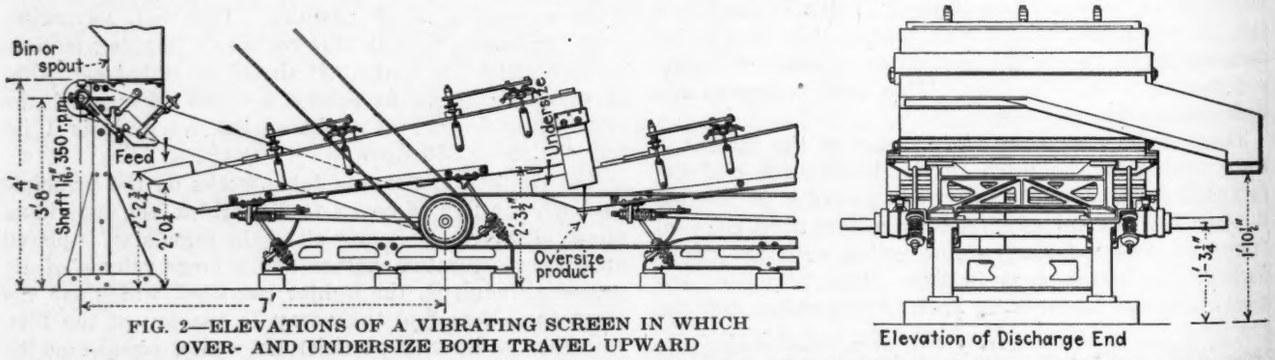


FIG. 2—ELEVATIONS OF A VIBRATING SCREEN IN WHICH OVER- AND UNDERSIZE BOTH TRAVEL UPWARD

Elevation of Discharge End

In the early days of the industry the point of feed of a screen was much above the point of discharge. With the introduction of shaking screens it became possible to lessen the difference between them. Finally someone bolder than the rest, desiring to save tipple height, made the screen bed level. Here is a series of screens in which each screen is level with its predecessor but nevertheless is fed from it. To do this the undersize travels on an upward grade of 7 deg. and the oversize on a grade of 12 deg. The movement of the screen is only one-inch and the action one of vibration rather than of shaking. Each screen reciprocation is independent and out of step with the rest, thus vibrating the screen without excessive vibration of the structure in which it operates. Five screens are set in one bank, the undersize traveling from one screen to the next.

the pneumatic tables. The experience in tests made confirmed us in that opinion. In consequence two spiral separators were installed for cleaning the larger sizes.

The plant was planned to take the screenings direct from the tipple to the cleaning plant and to return the cleaned coal to the tipple either for mixing with the hand-picked lump to make a clean mine-run or for shipment as a stoker coal, all the cleaned sizes being combined for that purpose. In order that a belt conveyor rather than an elevator might be used to bring the raw coal to the cleaning equipment, the plant was placed 230 ft. from the tipple. A 30-in. belt conveyor 250 ft. long between centers and having a rise of 63 ft. takes the raw coal from the tipple to the plant.

This discharges into a revolving screen 5 ft. in diameter and 13 ft. long. The upper 8 ft. of this screen has 1-in. square perforations. The undersize drops into a 30-ton bin which supplies the anti-gravity screens. The lower 5-ft. section of the revolving screen has 1½-in. square perforations, and the undersize drops to a 5-ton bin which supplies the left-hand spiral. The oversize of the 1½-in. screen goes to another 5-ton bin which supplies the right-hand spiral. These three bins discharge at a point about 4 ft. above the screen floor, which floor is 48 ft. above the ground.

The anti-gravity screens are placed in two batteries of five each, 8 ft. 3 in. apart from center to center and equidistant from the center line of the building. The No. 1 screens are each fed from the 30-ton bin by a reciprocating feeder which delivers coal over the full width of the screen. These feeders as well as those for the cleaning tables are patented by Sutton, Steele & Steele. They admit of accurate adjustment and are satisfactory in every way.

The screen meshes are as follows: ¾ in., ½ in., ⅜ in., ⅛ in. and ⅛ in., the first two being square mesh and the other three "ton-cap." The oversize from each screen is spouted to a steel pocket of about one-ton capacity which is hung from the bottom of the screen floor beams. These pockets are directly over and spaced exactly to suit the cleaning tables on the floor below.

The coal from the two small bins is fed to the spirals by small shakers of the Parrish type. Spirals for cleaning bituminous coal have a bad name because they do not clean satisfactorily all kinds of bituminous coal. Before adopting them we visited a large plant in Illinois where the results seemed to us to be poor, and a small plant in Oklahoma where the results were good. Much criticism is heard at Brilliant, largely, I think, because the 25 per cent of bright clean coal of this size in the waste pile shows up quite plainly, whereas at a wet washer, where the presence of the coal in the refuse could not be seen but could be ascertained only by analysis, a waste containing an equal percentage of coal would be considered acceptable.

In spiral cleaning, as you know, the specific gravity of the materials has nothing to do with the results. The difference in the coefficient of friction makes the separation. On steel chutes coal slides more rapidly than slate or bone and by centrifugal force is thrown over the side of the spiral chute into the outer collecting spiral. The slate, as it travels only slowly, stays in the inner spiral to the lower end, which thus becomes the waste chute.

Remember that the material, particularly the waste, must slide and not roll. Therefore, if the impurities in any coal are inclined to be round or cubical in shape they cannot be removed by spirals. At Brilliant the impurities are largely thin, flat pieces of slate. In every full-day test we have made of Brilliant coal the spirals cleaned as well as the ¾-in. pneumatic table. One full-day run of Koehler coal showed equally good results. We lately tried cleaning 3-in. to 1½-in. nut coal from the Sugarite mine. In this test the results were not at all good.

The waste from the spirals is conducted in chutes to a cross conveyor where it combines with the other waste and is taken to the waste pile. The clean-coal discharge is so arranged that it can either be mixed with other sizes in the main clean-coal bin or diverted to a sep-

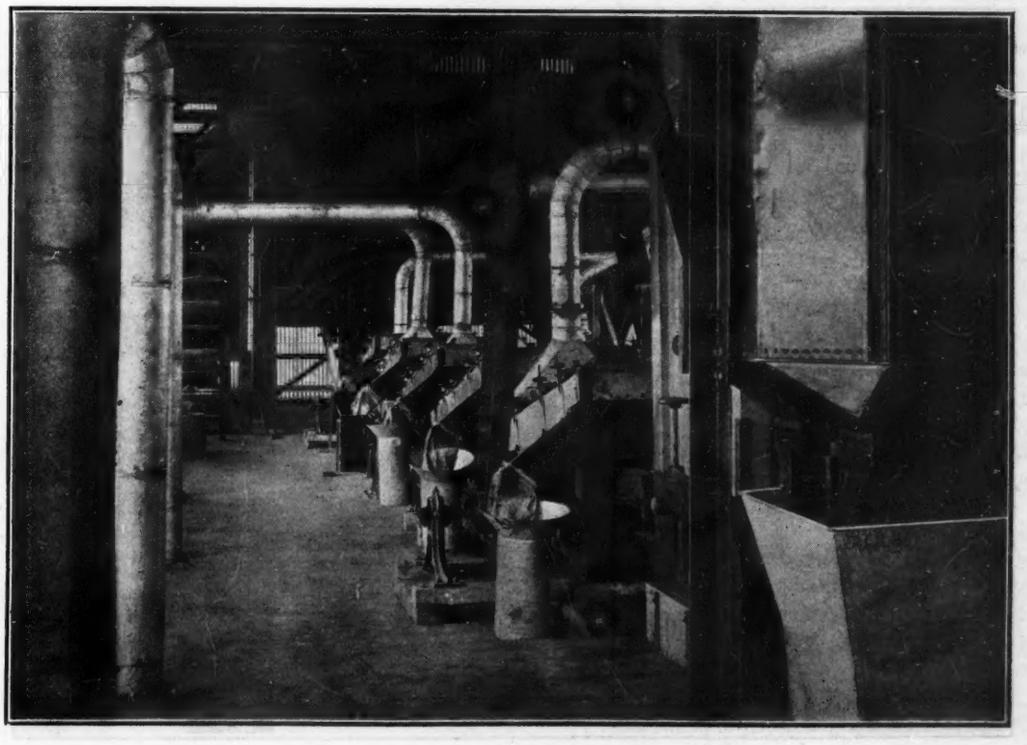


FIG. 3

Battery of Screens

The oversize is taken off at the upper end of the screen and goes by a chute spout to a vertical pipe leading to a small bin over a coal-cleaning table on the floor below, a cloth hood being used to prevent the escape of dust. It will be noted that dust-collecting hoods are placed over the point at which the undersize of the one screen is delivered to the top of the next for further screening.

arate bin on the other side of the building, from which it can be loaded into railroad cars as a pea coal.

To return to the anti-gravity screens, the last unit in each battery takes off the particles larger than ¼ in. At most mines it would not be worth while to screen or clean coal smaller than that, but at Brilliant this size contains more impurity than any other. It seemed to us easier to remove the dust from this last undersize by air than by screening.

Sutton, Steele & Steele make a machine for this which they call an aspirator. It consists of an inclosed chute 1 in. deep and 30 in. wide on a 50-deg. slope which joins another vertical chute which has the same dimensions at the junction point but is widened at the top and bottom, the top being converted into a 10-in. circular pipe which leads to a suction fan, the bottom becoming a discharge. The coal is taken from the undersize delivery of the last screen by a small bucket elevator about 12 ft. high and is delivered through an inclosed spout to the aspirator.

The fine coal thus joins the air current in a thin, wide stream. The velocity of the air at this junction slot is about 7,000 ft. per minute. Nearly all the dust below 60-mesh is removed. The coarser particles from 60-mesh to ¼ in. drop into a pocket over the No. 6 cleaning table.

The pneumatic tables occupy the floor below the screens. They are placed in two batteries, right and left, under the steel pockets as shown. The same type of feeder as is used as for the screens, but the feed is only 12 in. wide. This removes the coal from the steel pockets and delivers it to the tables. The table completely reciprocates 350 times per minute, each stroke being ⅝ in. long, but a pair of cone pulleys provides adjustment so that the number of reciprocations can be increased or decreased about 50 strokes per minute. The fan for each machine has its own speed of operation. The speeds are as follows: No. 1 table, 1,040 r.p.m.; No. 2 table, 1,040; No. 3 table, 1,540; No. 4 table, 1,000; No. 5 table, 1,000, and No. 6 table, 900. As may be noted from the plan, the clean coal drops directly into a storage bin occupying the next lower section of the building.

The lower part of this bin is provided with gates and chutes for loading railroad cars alongside the building and on the underside are pipe outlets delivering to a belt conveyor which takes the clean coal back to the mine-run car at the tipple. This conveyor must stop when the tipple stops, and when this occurs the pipe outlets soon fill up at the belt and stop automatically. The middlings from both batteries of tables are delivered to a single belt conveyor which leads to a bucket elevator at the end of the building. This discharges into the 30-ton storage bin. The waste from each battery of tables falls onto a separate conveyor and each of these delivers to a cross conveyor which takes all the waste out of the building and delivers it to the waste pile.

This completes the description of the process except for the dust-collecting apparatus. It was known from the beginning that we would require such a unit; first, for the operation of the aspirators and, second, to free the building from dust. The one installed is manufactured by the Clark Dust Collecting Co., of Chicago, and is designed specially for our needs. It consists primarily of a 60-in. Claridge fan placed between two collecting cones, or cyclones, as they are often called.

The fan draws air from the sources of dust through headers and through branch pipes through the first cone and through the fan and then forces it through the second cone, discharging it to the atmosphere. The precipitation of dust is nearly perfect. The difficulty is to get the dust into the pipes. We tried to place dust hoods at all points where dust was liberated. These hoods will not get much dust unless the air enters at high velocity. The cross-sectional area of the hood opening must be no greater than that of its conductor pipe.

The pipe branches to the hoods generally were of 7-in. diameter and the hood 30 in. wide. Therefore the

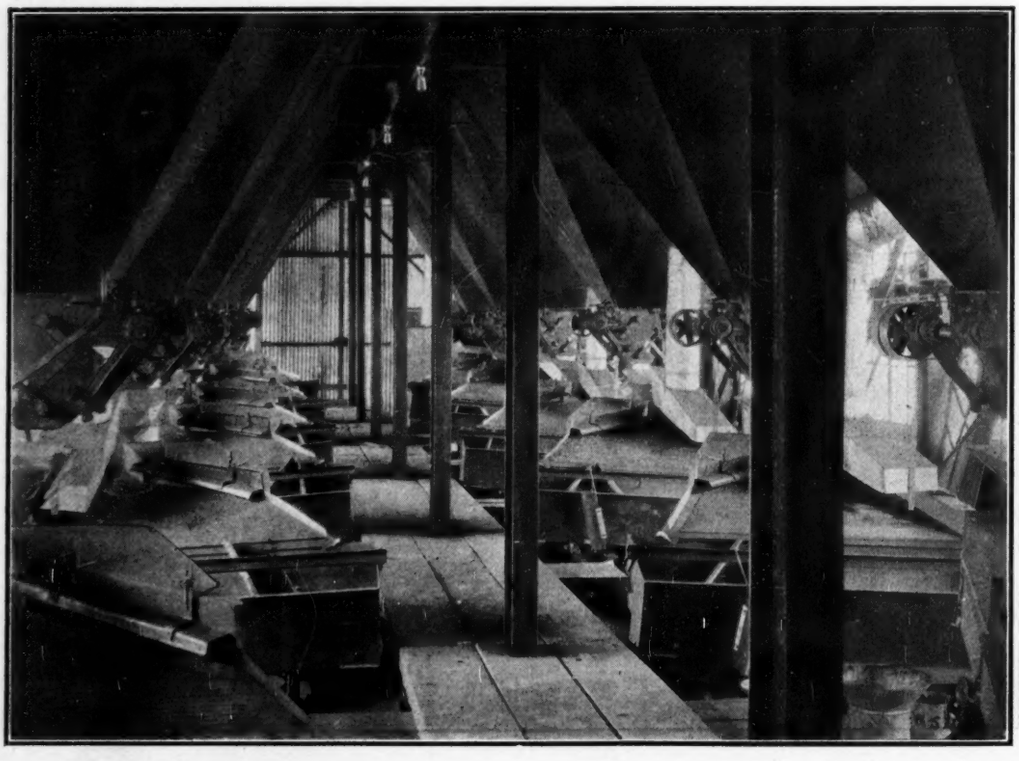


FIG. 4

Coal-Cleaning Tables

Coal comes to these tables from the screens above, which are so spaced as to deliver the coal at the desired point. Three kinds of material are made on the table — coal, middlings and refuse. The middlings are taken back to the main feed bin, resized and given a second cleaning. This continues until they ultimately line up either with the coal or the refuse. In the end there is no middlings product, only clean coal and waste material

width of opening could be only about 1¼ in., but it is clear that a hood opening 30x1¼ in. will not reclaim dust from a wide area. We placed one hood at the discharge of the raw-coal conveyor, one at each anti-gravity screen feed, one at each screen discharge and one large pipe to each aspirator. On the cleaning floor one hood was placed at the feed of each cleaning table. The revolving screen had no dust hood, and we soon found that it produced much dust.

We partly inclosed it and placed a collector branch in one side of the housing. Though this improved the dust-collecting qualities, the hoods still do not collect nearly all the dust. At the cleaning tables the condition is worse. The hood at the feed collected much dust but a greater quantity was liberated after the coal had spread out on the table. To collect this is difficult, perhaps impossible. About 6,000 cu.ft. of air per minute comes up through the table deck. Even a 9-in. pipe and hood would take only about 1,500 cu.ft. Consequently the floor containing the cleaning tables is still a dusty place.

The application of power was planned as follows: On the screen-room floor a 50-hp. motor was placed which drove a line shaft running across the building on the level of the floor beneath the revolving screen. From this line shaft belts were run to the raw-coal conveyor, the revolving screen, the middlings elevator and the anti-gravity screen.

On the cleaning-table floor a 100-hp. motor was placed driving a line shaft on one side of the building. This in turn drove a similar shaft on the opposite side. These shafts drove the table fans directly through belts and, by means of countershafts, drove the shafts of the eccentrics on each table, the conveyors and the feeders. Separate motors drive the dust-collector fans.

The conveyor galleries and the main building are constructed entirely of steel and are covered with corrugated iron and lighted by windows having steel sash. A plant outside the building furnishes steam heat. The electric wiring is all in conduit with dustproof light sockets.

Difficulties in Early Operation of Plant

From all this it might seem that the plant would work smoothly and without difficulty. Nevertheless there have been difficulties. First, these anti-gravity screens, although connected by chain drives to keep them out of step, cause much vibration. The floor beams of the screen floor were 12-in. I-beams 2 ft. 6 in. apart and of 30-ft. span. These were amply strong, but they had excessive vibration, so we ran a 12-in. I-beam under the center with 8-in. I-columns at each bent. This could be done, we found, without seriously obstructing the floor on which the cleaning tables operated.

Then, also, the dust was unpleasant and perhaps dangerous. Not only that, it stuck to the belts and pulleys and caused them to slip. Making the belts very tight caused great friction on the line shafts and nearly doubled the power required. You will note that the drives to the fans are not very good, being nearly vertical and having short centers. The main drive from the motor is not much better.

Not realizing at first that the friction of the tight belts would cause a great loss of power we put in another 100-hp. motor. Later we widened the belts and with less tension reduced the power to normal. The dust was still bad, so we installed another collector unit,

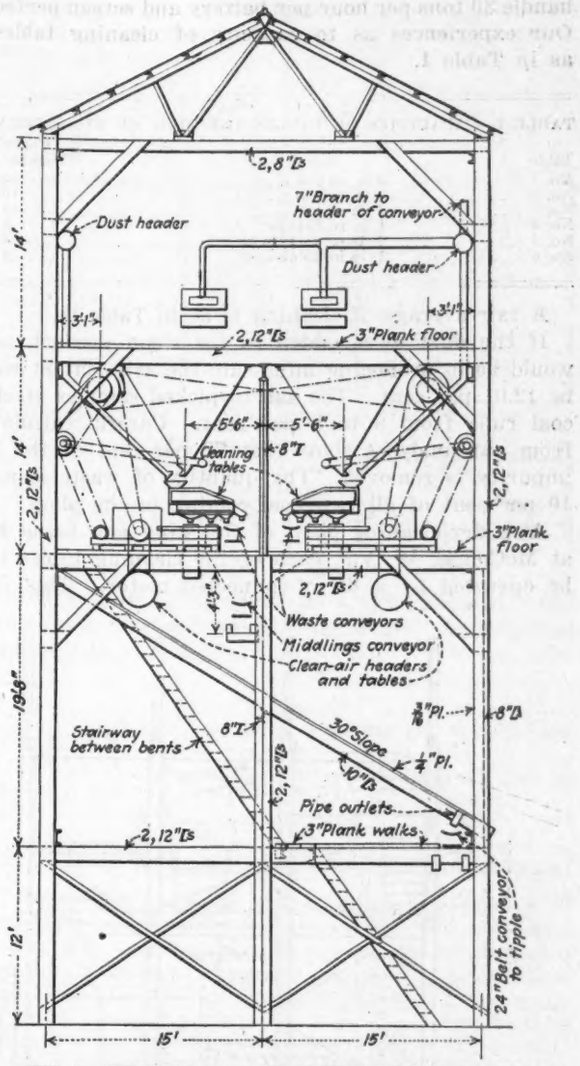


FIG. 5—VERTICAL CROSS-SECTION OF BUILDING

This elevation shows how the middlings and waste discharge of the tables are disposed of. The middlings and the waste each goes to its own conveyor. Note the almost vertical drives and the system by which clear air is taken to the tables and the dusty air is removed to the dust header.

dividing the headers between them. As the air was still dusty we covered all motors with airtight sheet-iron boxes or houses ventilated by intake and outlet pipes extending outside the building.

Then we were confronted with the greatest difficulty of all. The anti-gravity screens were supposed to operate at 300 strokes per minute and were so installed. At this speed the capacity was small. We had to increase the number of strokes to 350 to get 30 tons per hour with each battery. The eccentrics then began to break. We replaced them with wider and heavier eccentrics. Then the lugs to which the rods are attached began to break. We installed much heavier lugs, but then the pull-back springs began to break. The makers furnished heavier ones, but even now they often break.

The makers have devised and manufactured another screen of this type with a somewhat different driving mechanism which may be all right. If you buy any, first test them in an all-day run at full capacity. The cleaning tables work perfectly and never have needed repairs. All parts of the plant except the screens are now working satisfactorily.

As to the results of dry cleaning, the screens will

handle 30 tons per hour per battery and screen perfectly. Our experiences as to capacity of cleaning tables is as in Table I.

TABLE I—CAPACITIES OF TABLES AND SIZE OF COAL TREATED

Table	Size of Coal	Capacity, Tons per Hour
No. 1	1 in. to ¾ in.	12
No. 2	¾ in. to ½ in.	10
No. 3	½ in. to ¼ in.	8
No. 4	¼ in. to 3/16 in.	6
No. 5	3/16 in. to 1/16 in.	4½
No. 6	1/16 in. to 60-mesh	3

A fair average of cleaning is as in Table II.

If the dust were added to the clean product, as it would be in producing mine-run, the ash content would be 12.01 per cent. The ash in picked samples of clean coal runs from 8 to 9 per cent. Careful calculation from our analyses show that 72 per cent of the free impurity is removed. The quantity of waste is about 10 per cent of all raw coal coming to the plant.

At a dry-cleaning plant of this kind now being built at McComas, W. Va., each of the cleaning tables is to be operated by a direct-connected motor. This is in line with modern practice, but if you are going to build a plant do not forget about the dust. From our experience we conclude that a far better plan would be to place all motors outside the building and drive every unit from a line shaft.

TABLE II—PRODUCT RECEIVED AND DELIVERED BY TABLES

Table	Ash in Raw Coal, Per Cent	Ash in Cleaned Coal, Per Cent	Ash in Waste, Per Cent
No. 1	17	11	63
No. 2	17	10.5	65
No. 3	16	9.5	70
No. 4	18	10	66
No. 5	22	14	70
No. 6	25	19	70
Total	16.83	11.06	64.6

The power required to run this plant is shown by meter readings to be 200 hp. Four men are required to operate it, a foreman and three laborers. The cost of constructing such a plant is perhaps 20 per cent more than for a wet-process plant. The cost of power is a little higher, but the labor cost is about the same.

There is, in my opinion, no good reason why this dry process should displace washing except in certain cases: First, if water is not available except at great cost; second, if the cleaned coal is to be shipped in railroad cars. In this case allowance would have to be made the customer for the water content, but someone would have to pay the freight on at least 6 per cent

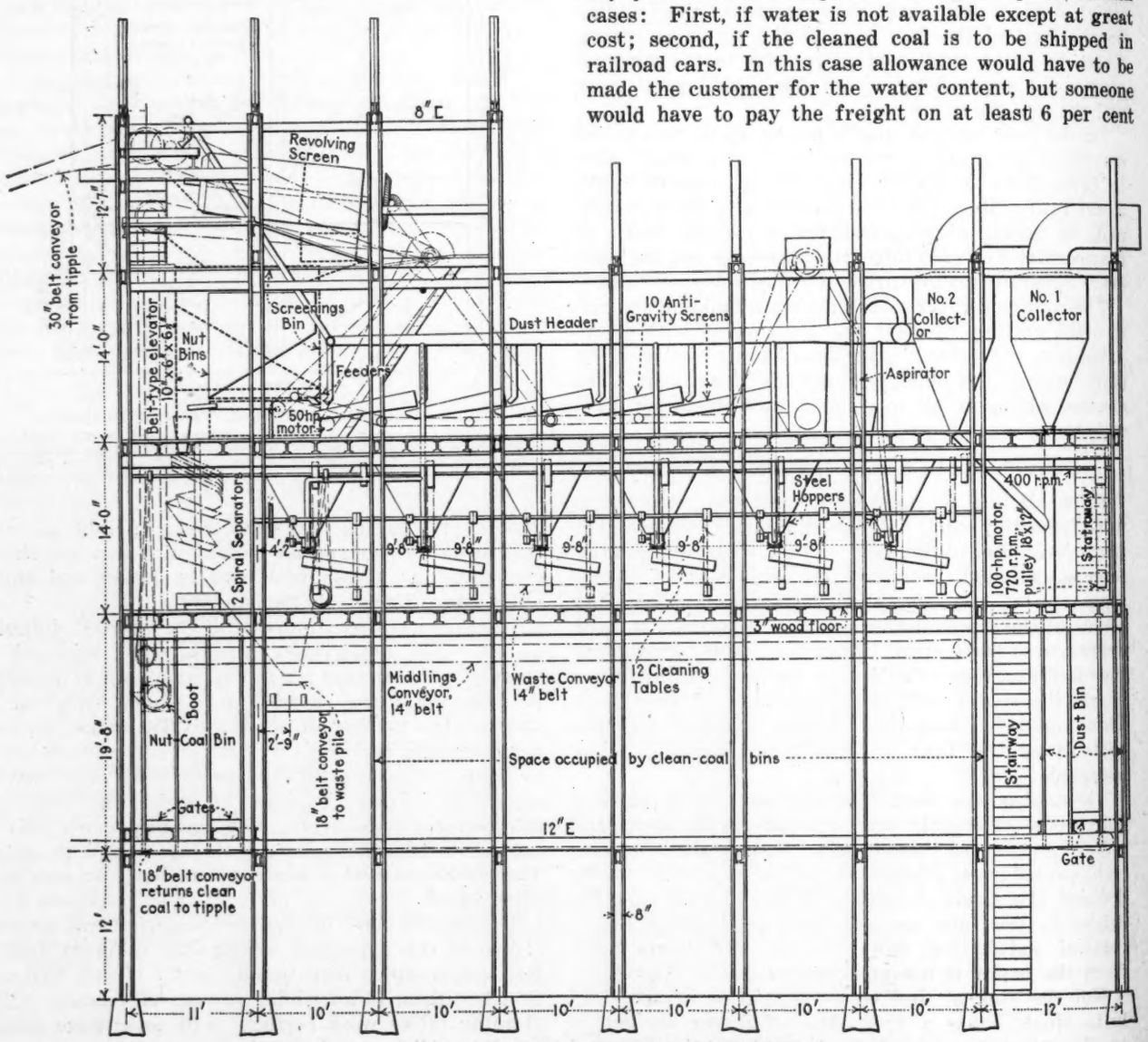


FIG. 6—LONGITUDINAL SECTION OF WASHER

This drawing shows the relation of the five screens in each bank to the six tables to which their product passes. It also shows the conveyors for middlings and waste. The space below the table floor is used for clean-coal bins. The system for removing dust also may be noted, as also the spiral separators and the drives.

of water. Third, if the coal is to be used at a powdered-coal plant. The size of coal prepared by the dry-process tables is finding an increasing market at plants which use powdered coal. At such plants fully half the machinery and more than half the expense is for drying the coal. At many mines such as Brilliant this dry-cleaned product if shipped in closed cars can go direct to the pulverizers without drying.

The steel structure and covering at the Brilliant plant was built by the Kansas City Structural Steel Co. after our plans and their own details. The conveying and transmission machinery and the revolving screen were furnished by the Link-Belt Co., and was, I think, perfect in every detail.

Paper Discussed at Rocky Mountain Session

At the completion of the paper, E. H. Weitzel asked what disposition was made of the middling product from the tables. Mr. Young stated it is sent back to repeat the process, over and over again, in a closed circuit, until it finally passes to the clean coal or the waste pile. In reply to a question by F. W. Whiteside, Mr. Young said the spiral could not handle wet coal. This agreed with Mr. Whiteside's experience, that as long as the coal was dry the spirals worked, but when the coal was wet they were no longer efficient. Mr. Young said the spirals are adjustable for various temperatures.

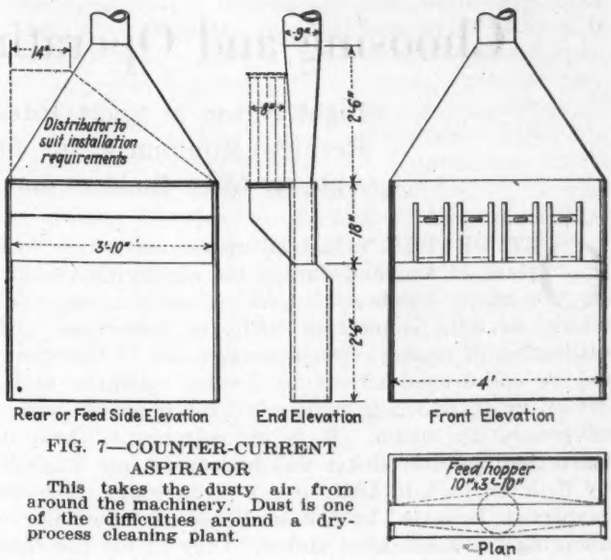


FIG. 7—COUNTER-CURRENT ASPIRATOR

This takes the dusty air from around the machinery. Dust is one of the difficulties around a dry-process cleaning plant.

Bureau of Mines Now Has Leasing Branch; Changes in Personnel

Continued growth of the U. S. Bureau of Mines, especially in the supervision of leasing operations on public lands, has resulted in the creation of a leasing branch within the bureau, the appointment of another assistant director, and several changes of personnel within the organization.

General operations under the leasing act of Feb. 25, 1920, development of lands in the naval reserves, and the supervision of operations on Indian lands have combined to make the federal government an outstanding factor in the production of minerals. Wells drilled on public lands, including the naval reserves, now produce approximately 3,000,000 barrels of oil monthly, or at a daily rate of 100,000 barrels. This production is outside of that from Indian lands. Coal leases and prospecting permits have been issued in fourteen Western states, in which the federal government is supervising the operation of 89 mines.

A. W. Ambrose, assistant director, has been placed in charge of the newly created leasing branch. He also will act as a consulting engineer to all branches of the bureau on matters relating to petroleum and natural gas.

D. A. Lyon, chief metallurgist and supervisor of stations, has been appointed assistant director in charge of the research branch, which includes the functions and scope of the former investigations branch after the elimination of leasing matters. For the present no appointment will be made to the position of supervisor of stations and Mr. Lyon will perform the duties of supervisor in addition to those of head of the research branch.

T. T. Read, having asked to be relieved from his position as chief of the information service and assigned to investigative work, has been appointed a supervising mining engineer. During the absence of F. J. Bailey, assistant to the director, on a visit to the mine safety cars and stations, Mr. Read will serve as acting head of the operations branch of the bureau and will later be assigned to appropriate field duties.

C. E. Julihn has been recalled from service as chief mining engineer of the War Minerals Relief Commission and made chief of the information service. Francis Winslow, now connected with the division of war minerals supply, has been assigned to serve with the War Minerals Relief Commission as chief engineer. J. W. Furness, who has been working with the war minerals supply division of the Bureau of Mines, has been given a permanent appointment in that division.

All of these changes and appointments became effective as of March 1, 1923.

How About Federal Ownership of Flivvers?

If Henry Ford believes in government ownership of railroads because the people should control their own transportation does he also believe in government ownership of automobile factories for the same reason? P. H. Greenlaw of the Fifth and Ninth Districts Coal Operators Association, in St. Louis, Mo., wants to know. He can't seem to get Henry Ford to answer, in spite of his best efforts to melt the wires between St. Louis and Detroit, Mich.

It all started when Mr. Ford was quoted sensationally about railroads and coal in the May issue of a magazine from the Hearst yellow presses. Among other things Mr. Ford was made to say: "No people can be free and go unrobbed who lack the power to move about and have their goods moved about without making terms with private interests." Reading this argument for government ownership of railroads, Mr. Greenlaw began bombarding Detroit with queries. He wired asking if Mr. Ford had been correctly quoted. Mr. Ford's first secretary replied he knew "nothing regarding statement reference to your telegram." Whereupon Mr. Greenlaw tried again, asking further if Mr. Ford favored government ownership of the automobile industry as well as railroads. Mr. Ford's second secretary replied that Mr. Greenlaw should write Mr. Ford a letter about it.

Mr. Greenlaw wired again and marked it "Personal." This time he said: "My inquiry needs no elaboration. It is simply: 'Are you in favor of government ownership of the automobile industry?' You surely would not advocate government ownership of property belonging to other people and be opposed to government ownership of an industry that enables one individual to pile up the wealth and power that the automobile industry has enabled you to secure." No reply. Mr. Greenlaw waited two days and then despatched another one saying: "Do you decline to commit yourself?" Still no reply.

So the country remains in ignorance of whether Mr. Ford would like to turn over his factory to the government along with all railroads so that the people "can go free and unrobbed," because they would then have "the power to move about and move their goods about without making terms with private interests."

Choosing and Operating an Underfeed Stoker

Light Firing at Short Intervals Early Found to Give Best Results—Equipment for Steam Plant at Mine Must Be Able to Meet Sudden and Wide Variations in Demand

OUT OF THE industrial revolution which took place in England during the eighteenth century came a number of basic inventions, many of which were in connection with the generation and utilization of steam. The improvements of the steam engine encouraged efforts to develop machines to be driven by it, which in turn called for improved means of generating steam. It is not surprising, then, to learn that the first stoker was introduced into England by Brunton back in 1822, over a century ago. We are perplexed, however, by the tardiness of industries in adopting the mechanical stoker. Only in the past few years has it been recognized as an aid to efficiency.

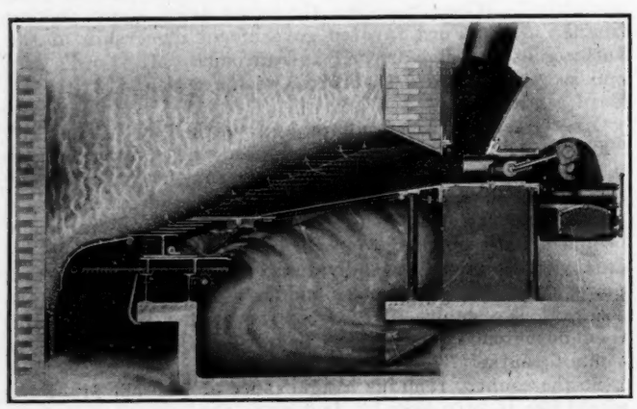
Steam is most extensively used in the railroad industry, where it is a direct agent of motive power, and it is here that one must turn for early methods in its generation. In the early days of little power and small trains light firing at short intervals was discovered to give best results, and it finally struck the locomotive fireman that his job was not to see how much but rather how little coal could be shoveled into the furnace and yet obtain satisfactory results. This led to the practice of loading several scoops of coal just in front of the furnace door, followed by the pushing ahead and the breaking up of the caked mass to allow a replenishment of fuel at the door. To this day the method of hand firing the locomotive has not materially changed, and this so-called coking method of hand firing furnaces was used in many industries prior to the introduction of the stoker.

It was learned also that to load coal into a furnace promiscuously was to defeat the end desired—a uniform temperature—and that the stack loss is increased because combustible gases arising from the fuel bed are only partly burned and because the temperature falls when the flames are smothered. As a consequence, the pressure of the steam drops correspondingly. For bituminous coal good practice calls for the depositing of fresh fuel on bright spots in the fuel bed, as these are indications of a local thinning out; and if best results are to be obtained a level bed of uniform thickness must be maintained. In reality this is a checkerboard system of hand firing and no existing stoker has analagous principles of operation which demand the human element for success. Hand firing by spreading had a large following where anthracite was used. In this system the coal was scattered in thin layers over the entire fuel bed, and it produced excellent results because clinkering was not a serious problem in the combustion of anthracite.

There still remains one other scheme of firing furnaces by hand which was used to a limited extent in the early days, and that is the alternate, or side-firing, system, wherein the fuel bed is divided from front to rear into two sections which are alternately fired and cleaned, so that while one half burns intensely the other half is comparatively green and passing through the process of coking. The side-feed inclined stoker operates on a modification of this principle in that it has two fuel beds independent of each other.

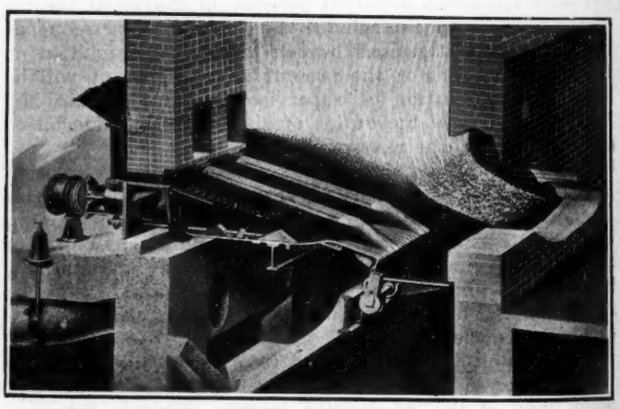
As in choosing a particular type and capacity of mine pump to meet a given condition in a mine or in selecting different types of motors under different circumstances, care must be exercised in the application of mechanical stokers to the needs of the boilers, depending upon the demands of the plant. Economy cannot be obtained by correct operation of the stoking mechanism itself, to obtain the best results other factors must be in harmony, such, for instance, as a unit properly proportioned to the boiler and the load demand. Under one set of conditions a chain-grate stoker might be advisable and the use of any other type would be a misapplication likely to end in failure. Under other conditions the chain-grate stoker should not be considered. Many of the troubles encountered in steam plants may be attributed to incorrect design, and to guard against these is the duty of the engineer. After a careful survey he should decide upon the particular type of stoker which best meets the conditions.

Thus at a plant with a fairly uniform load through-



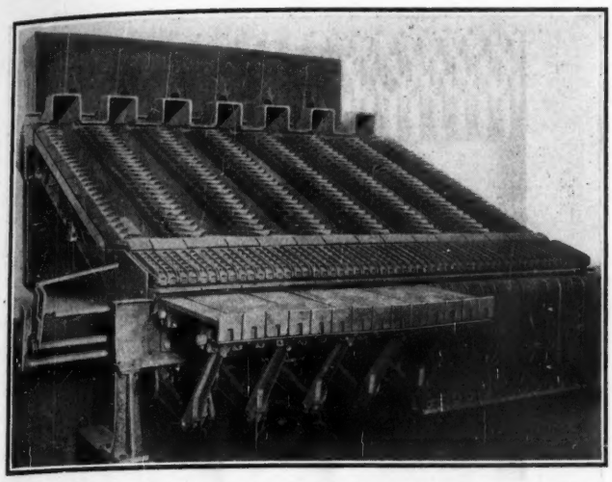
RILEY STOKER, IN WHICH THE RETORTS RECIPROCATE

This stoker is singular in that the entire grate area is adjustable and movable. Reciprocating motion of a steam plunger is transmitted from a wrist pin by connecting rods to the bearing bars. The retort, overfeed grate and ash tray alike reciprocate.



JONES A-C STOKER HAS NO OVERFEED GRATE

Movement and agitation of the fuel is dependent upon pusher blocks connected to the steam rams. The distinctive feature of this stoker is the automatic control of fuel and air effected by auxiliary devices.



TYPE H TAYLOR STOKER ADAPTED FOR COMBUSTION OF LOW GRADE FUEL

Reciprocation of the extension of overfeed grate is effected by the same mechanism which moves the rams. A steam cylinder imparts quick motion to the dump plate, loosening the clinkers which adhere to it.

out the day only a small excess rating is required as compared with a plant where the demand rises and falls in a twenty-four hour period, as in a mine plant. Here economy calls for a large enough but not too large a plant, and in the design allowance must be made for day-to-day variations in demand as the mine is further developed or the production is more or less than normal. The plant must be designed to minimize expenses in adding new units and at the same time provide the utmost simplicity of operation. The proportionate horsepower increase as a ratio of increase over total demand from period to period as the mine workings are extended is greater at a mine generating its own power than the proportionate horsepower increase in a large commercial power plant. In the latter case the load factor usually tends to become better, especially where the industries served are of different characters with respect to load.

In the selection of an electric motor the first quality to be investigated is its performance characteristics; likewise in looking about for a stoker to meet the needs at the mine plant, for the same reasons, one should study its application characteristics. The application of the same stoker to different types of boilers, even of the same horsepower, will produce different results. First the stoker must be chosen, then a boiler must be selected, and finally the furnace must be designed to derive the greatest efficiency from both. The three parts that go to make up the whole—the boiler, the stoker and the furnace—must be correctly proportioned to one another. For instance, it is much easier to proportion a boiler and furnace having the type and size of stoker in mind than it is to select the stoker after having decided upon a boiler and designed the furnace; in other words, as in the building of a house, the basement must precede the roof in construction. The application of a stoker to an old installation of a hand-fired boiler furnace often develops embarrassing difficulties that are not easily overcome, and great care should be exercised to obtain as nearly correct proportions as possible; otherwise poor plant operation will follow and the blame will be placed upon the stoker.

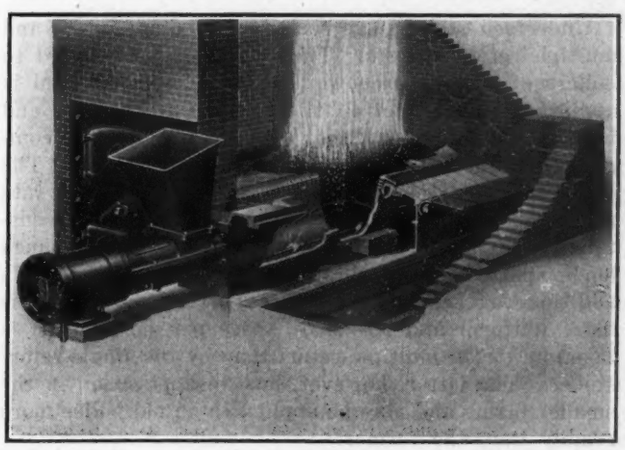
Another factor that must be considered when selecting a stoker is the fuel supply—the kind and grade of the coal to be burned must be taken into account. Those coals which have a tendency to cake burn better in a stoker which agitates the fuel bed in a manner to prevent caking; in extreme cases of caking forced draft may be needed to insure sufficient air for complete combustion. On the other hand, there are coals which do not have that tendency to mass. If these are introduced into a furnace having a stoker that agitates, best results are not obtained, as the fines are unduly sifted through the grates. The free-burning coals of the Middle West do well on the chaingrate stoker chiefly because it is not unduly agitated. The high ash content of these coals combats free agitation, and relative advancement from grate bar to grate bar is well nigh impossible with some of these, hence in this instance the traveling grate is best.

As we will deal with only one type of stoker in this article, the underfeed type, the application of several kinds of coal will be mentioned only as concerning this one type of stoker.

Of the three types of stokers, the underfeed stoker undoubtedly gives the best results when burning the low-volatile coals such as those of Pennsylvania and West Virginia. They are comparatively low in volatile matter and high in fixed carbon; they tend to cake in large masses in the early stages of combustion and consequently require agitation for efficient combustion. Extensive tests by the U. S. Bureau of Mines have proved that the greatest percentage of these coals have high fusing temperatures, for which reason agitation is not likely to cause clinkering trouble.

The valley-and-hill design of underfeed stoker with its retorts flanked by tuyere boxes affords a favorable condition for the burning of these coals. With a forced draft the fire may be thickened with less danger of its contents massing. The natural swelling and caking properties of these coals cause them to expand upward on heating. The simultaneous action of the air forced from the tuyeres and the lifting of the fuel in the retorts by the movement of the pushers does not afford an opportunity for extensive caking. Because the content of volatile matter is low the combustion is fairly complete in the fuel bed itself and consequently the heating surface is closer to the flames than is the case where high-volatile coals are burned, as the latter require more space above the fuel bed for ignition of the gases given off.

High-volatile coals with a moderate ash content also possess the caking property characteristic of the low-



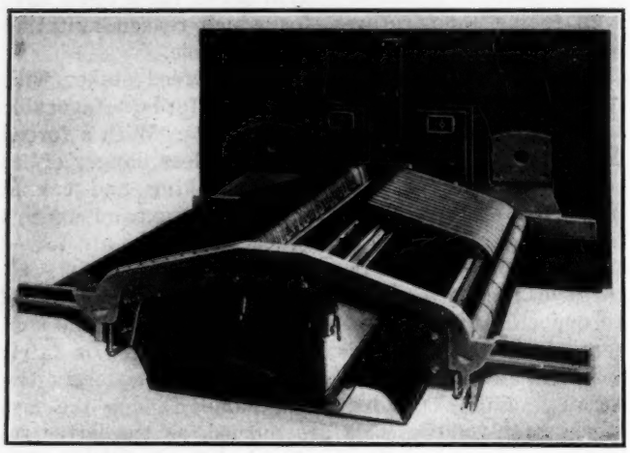
JONES SINGLE-RETORT UNDERFEED STOKER

Fuel is forced backward and sidewise by pusher blocks onto sloping combustion grates and then to hand-operated dump trays. The stoker is self-cleaning and simple in construction.

volatile coals but to a lesser extent. The thick fuel bed in the underfeed type of stoker furnishes an ideal condition for the distillation of the hydrocarbons. For this reason combustion is efficient and little smoke is made. However, the ash must be dumped at more frequent intervals because there is more of it.

One other kind of coal representative of major production in the United States, the high-ash coal coming from the West, having an impurity content varying from 6 to 30 per cent ash, presents problems in combustion depending upon its ash content. In the main it is a free-burning coal which tends to clinker, especially at high combustion rates, and to overcome this some means must be provided to prevent the adhesion of clinkers to the grates and brickwork. Best results are obtained by providing a continuous means for disposing of the ash, as, for instance, with a clinker grinder.

The working principle of the underfeed stoker is as follows: Fresh coal is fed upward and forward into the fuel bed by a pushing agent, usually a steam-operated ram. The fuel bed is made up of three layers which specifically may be called the green-coal zone, the coke zone and the incandescent zone. In the middle zone the volatile matter is "cooked" off and in the upper zone it is burned. Boiler ratings from normal to as much as 400 per cent may be obtained with the underfeed stoker.

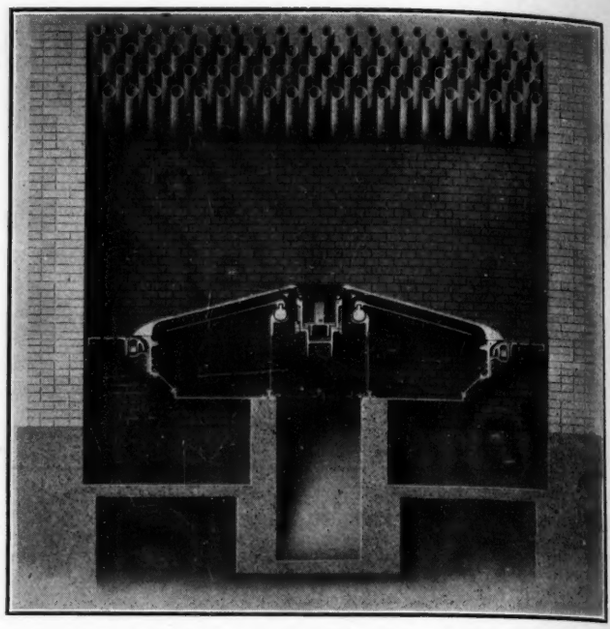


TYPE E STOKER SHOWING GRATES

This stoker has been perfected to control firing readily by means of a compensating-type damper regulator connected to a steam-driven engine, thus giving automatic operation.

Underfeed stokers are classified as single-retort and multiple-retort stokers. The former is best suited to boilers of small horsepower, not to exceed 350, and is applied to advantage to boilers which are set low and have no ashpit under them. Combustion may be completed with or without the aid of an ignition arch. The multiple-retort stoker provides a higher combustion rate per square foot of grate area and consequently will sustain peaks above boiler rating higher and for much longer periods than will the single-retort stoker. In addition to these merits the furnace temperature is more uniform and less floor space per horsepower is taken up by the multiple-retort than by the single-retort stoker. The latter, however, has an application in the smaller plants and may be applied to an old boiler more readily than the former.

Perhaps the simplest of stokers belonging to the single-retort class is the Jones standard side-dump stoker. On either side of the single retort are side



SECTIONAL VIEW OF TYPE E STOKER

Shows arrangement of ashpit and draft, also the relative position of grates with respect to the boiler tubes.

plates which support the fuel bed overflowing from the retort. Air from a blower travels to the fuel bed by way of a sealed ashpit, under ribbed dead plates, and thence through the tuyeres.

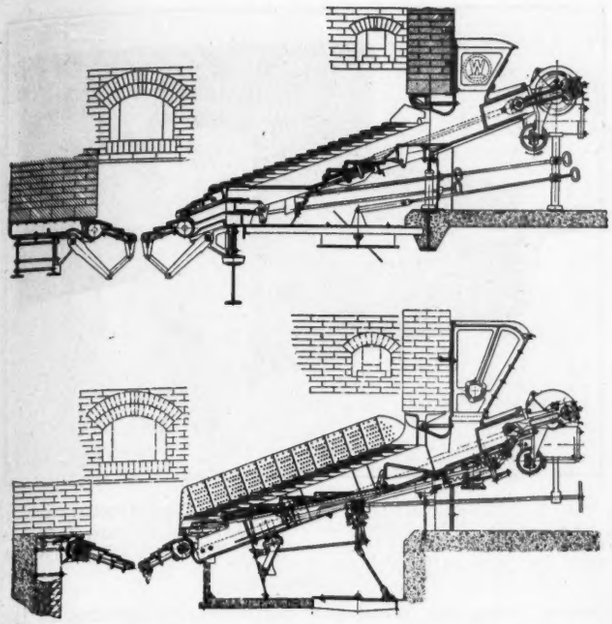
The outside equipment consists of a feed hopper to which is attached a steam cylinder operating the feed ram. Steam is admitted behind the piston and pushes the ram ahead and thus carries with it a portion of the coal to the retort, after which it is further relayed ahead by pusher rods.

The feature in the control of this stoker is the automatic steam control regulator on the steam line leading to the engine, which governs the speed of the engine and thus controls the speed of the fan and the feed of the coal to the retort. In this way an even pressure of steam is maintained and constant relation is sustained between the coal and air supplied for combustion.

With a small amount of brickwork and excavation for the ashpits this type of side-dump stoker may be installed under many types of boilers. The ashpits extend 6 to 18 in. below the floor line, depending on local conditions, and fuel is burned efficiently without combustion arches.

Retaining the simplicity of the Jones single-retort stoker, yet developed so as to preserve the merits of the multiple-retort design for large loads, the Jones A-C stoker differs from the other underfeed stokers which will be described.

Into a steam cylinder is fitted a piston to which in turn is attached a ram. When steam is admitted into the cylinder through an automatic control valve, the ram is withdrawn from the retort and coal drops in front of it. The operating mechanism is timed so that the valve reverses the flow of steam and the ram pushes the coal from the bottom of the hopper into the retort. The fuel already in the retort is pushed upward and ahead by pusher blocks fastened to auxiliary rams. Agitation of the fuel bed is accomplished entirely by these means. The overfeed section behind the retorts is not movable. The dump plates are made in sections which are hinged to a shaft running parallel to the



WESTINGHOUSE STANDARD AND NEW MODEL TYPES
Fuel is delivered to the grates by means of a cast-steel ram, shown under and just to the right of the hopper. Note that the overfeed grates are operated through a rod driven by the same mechanism that operates the feed ram.

rear of the overfeed section and are dropped toward the bridge wall by a control lever at the side of the stoker.

Other details are as described in the single-retort stoker of the same make. The control valve, which permits eight rates of operation, has already been described. In the multiple-retort type, however, a deep ashpit is employed together with necessary air compartments for forced draft.

Another stoker which strictly belongs to the single-retort class is the Detroit underfeed stoker, whereby coal from the feed hopper outside the furnace is fed ahead through the entire length of the retort. This ram is driven from a crank connected to a drive shaft and consequently its stroke is regulated directly by adjusting the length of the connecting rod. Likewise the rate of feed may be regulated by suitable adjustment.

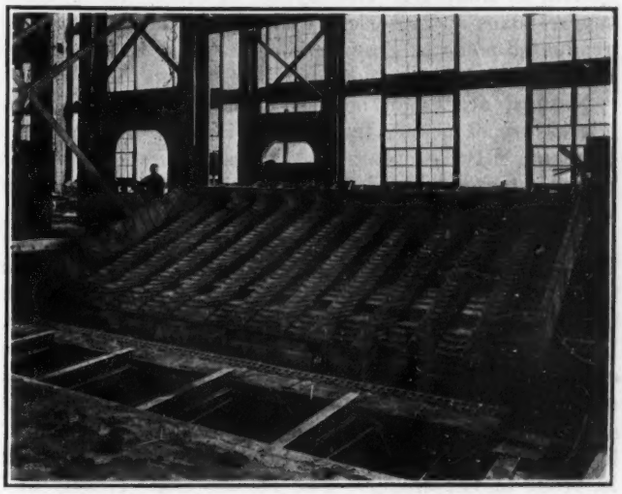
Like the Jones stoker, the sides of the retort are mounted by tuyere blocks alongside of which are ribbed grate plates. Burned-out ash is deposited upon solid dump plates which are dropped by a lever mechanism controlled from the front of the stoker. Forced draft is used in combustion. The blower directs air into sealed compartments and thence through unit sections of tuyere blocks to the fuel bed.

In the Roach single-retort underfeed stoker coal is fed to the stoker in the usual manner from a feed hopper by a steam-operated ram. In addition to the pushing action of the ram in the retort, the fuel bed is further agitated by reciprocation of inclined sectional side grates. The motion of these grates is adjustable to conform with the rate of combustion desired.

The side grates serve a dual purpose in that they agitate the fuel bed and, by reason of their hollow construction, act as conductors of air from an air chamber to the faces of the retort. Air for combustion is admitted to the combustion chamber under a high and a low pressure. The high-pressure air chamber is located under the low-pressure chamber and supplies the forced draft to the tuyere grates and also supplies air to the low-pressure chamber above it through a bleed-off valve which is controlled from the front of the furnace. This low-pressure air aids combustion by passing upward into the fuel bed on the grates through their interstices.

The Combustion Engineering Corporation builds single, double and triple-retort underfeed stokers, all of which in reality are of one type. They differ from each other only in so far as proportions and strength of construction are concerned. The double and triple-retort types, like the single, are known as the Type E stoker and are double and triple duplications of the single-retort stoker set side by side in one chamber.

Either coal-conveying machinery or hand labor delivers the coal into the stoker hopper, from which it is fed the full length of the retort by means of a reciprocating plate on the bottom of the retort. Then the coal is further distributed by auxiliary pushers attached to the bottom plate and alternate-moving fire bars which



CONSTRUCTION VIEW OF NEW MODEL TYPE
The ends of the rams are plainly seen and also the necessity for a wide hopper and ashpit.

form the side grates and carry the ash to dumping trays on either side of the side grates. These fire bars alternately are movable and fixed. The dumping trays are operated from without by a ratchet mechanism.

Air from the blower is conducted through a duct to the wind box located directly beneath the retort. From there it passes upward through tuyere openings in the retort end of the fire bars while the remainder passes through the hollow bars and is conducted to auxiliary air boxes under the grates. From the air boxes the air is vented to the fuel bed through slot openings between the fire bars.

Like the Jones stoker, the Type E stoker is automatically controlled by a compensating-type damper regulator which is sensitive to minute variations in steam pressure and connects with a throttle-valve on a steam driver or a rheostat on a motor.

In details of design and operation the Westinghouse underfeed stoker of the multiple-retort type is distinctive. The coal hopper is unusually large, being practically equal in length to the width of the furnace. Coal is delivered into the retort by a ram connected to a cast-steel crankshaft which is driven by a worm gearing.

To guard against damage, should foreign substances be admitted accidentally with the coal and block the movement of the rams, a small shearing pin is so placed in the speed shaft mechanism as to shear before the

initial stresses are transmitted to the working parts. The Riley and the Taylor stokers also are provided with such a shearing pin.

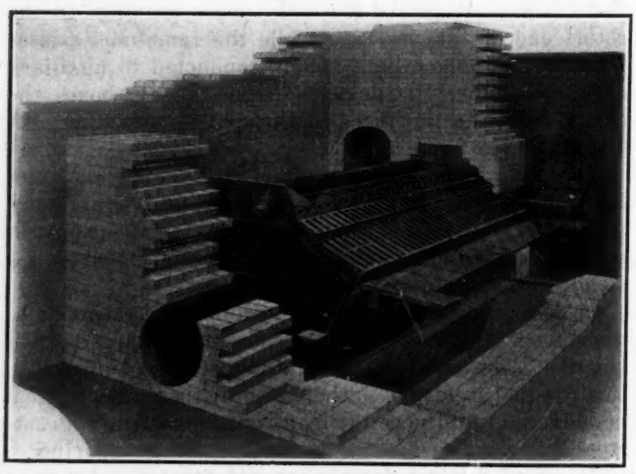
An auxiliary ram is operated by connecting rods through a lost-motion mechanism which causes it to reciprocate along the bottom of the retort and thus aid in the distribution of the coal. To aid the fuel in its movement to the dumping grates, beyond the retort-tuyere section are reciprocating overfeed grates which actuate through rod and lost-motion connections with the main ram.

Two dumping grates of interchangeable corrugated bars are pivoted upon brackets transverse to the center line of the retort and drop away from each other, thus providing a center dump operated from the side of the stoker. Air is controlled from the front or side of the stoker. Its passage from the wind box to the tuyeres and openings in the overfeed section is controlled by a system of dampers. The tuyeres fit into recesses in the tuyere boxes and interlock each other. The tuyeres are graduated so as to grow smaller progressively from the nose to the sides of the tuyere block.

Natural draft can be used at light loads and with a pressure of 6 or 7 in. in the wind box 400 per cent of rating may be obtained. This stoker is suitable for plants where the load is subject to wide and sudden variations.

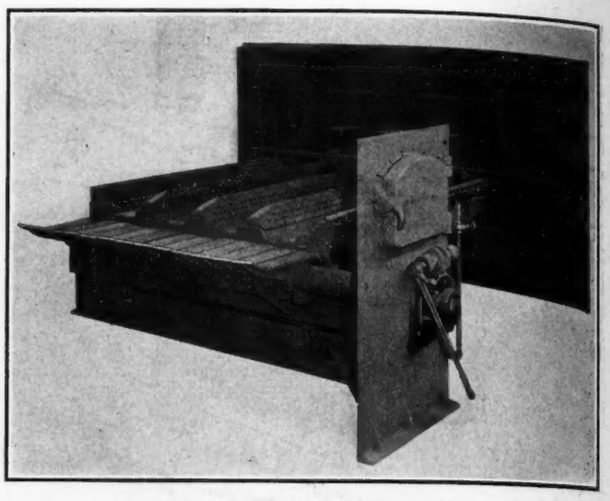
In the Taylor stoker, manufactured by the American Engineering Corporation, Philadelphia, Pa., the coal is fed into the retort by a large cylindrical ram which is operated by a crankshaft driven by a worm and gear. It is then redistributed by sets of short-stroke rams connected by links with the main ram. The grate area of a single retort set is composed of a retort inclined at 22 deg., an oscillating overfeed section and a single-leaf dumping grate which is operated by levers located in front of the stoker. The retorts slope steeply and are stepped by V-shaped tuyere blocks.

As an alternative for the hand-operated dumping grate a power dump plate may be used. This is arranged to oscillate rapidly so as to dislodge and dump the refuse and clinkers which might tend to adhere to its surfaces. Yet another provision for disposal of refuse is obtained in the clinker grinder which is sometimes used. It is revolved at a speed slow enough to keep ash above it at all times and thus seal it. Air for combustion is



DETROIT SINGLE RETORT UNDERFEED

This stoker was designed to serve boilers from 100- to 300-hp. For larger ratings two or more retorts are installed in one furnace.



DETROIT MULTIPLE RETORT UNDERFEED

Any number of retorts may be placed side by side, having a horizontal or level fuel bed. A row of tuyeres is placed between each pair of retorts, discharging air into the fuel bed.

forced from the wind box through the tuyeres to the fuel bed and also courses to the oscillating overfeed section. Both are controlled by dampers.

Bituminous and semi-bituminous coal, semi-anthracite and even lignite have been burned satisfactorily with this stoker. A wind-box pressure of 3 to 4 in. with 0.03 in. suction will permit continuous operation at 200 to 300 per cent of rating. From 60 to 80 lb. of coal per square foot per hour can be burned under peak-load conditions.

Different from all the stokers hereinbefore described is the Riley stoker in that the retort wall reciprocates and by direct-connection agitates the overfeed grate-bars which extend across the full width of the stoker. The underfeed section is inclined at 20 deg. and receives its reciprocation through side rods driven by wrist pins on the main plunger. The amount of travel is adjusted by setting blocks which regulate the lost motion between wrist pins and side rods.

Air leaves the main air chamber, which is fed by a duct from the blower and travels through the tuyeres to the fuel bed. A damper arrangement regulates the passage of air from the wind box proper to the movable overfeed grate, where its pressure is less near the dump grate than it is near the retort. The dump grate is composed of a number of dump plates that operate continuously. Refuse leaving these plates is further handled by a crusher.

This stoker will burn all grades of bituminous coal and also lignites. A rating of 200 to 300 per cent may be obtained with it.

LEGISLATION TO COMPENSATE FOR DAMAGE BY SUBSIDENCES.—The question of property damage through subsidence due to mining operations has long been a subject of controversy in Wales. Property owners, in offering for sale or leasing land, invariably reserve to themselves the right to work any minerals on the land, and to let down the surface without any compensation to owners of buildings or other erections. One of the Welsh coal-miners' leaders has suggested legislation to compel coal and other mineral operators to compensate property owners and public authorities for damage done to buildings, gas and water mains, sewers and highways through subsidences.

Better Machine Bits Would Lower Cost of Cutting Coal

Power Cost of Cutting by No Means Main Reason for Using Good Bits —Avoiding Burnouts, Reducing Strain, Economizing in Labor, Increasing Service from Machines Are Others—Standardization Needed

BY ALPHONSE F. BROSKY
Assistant Editor, *Coal Age*, Pittsburgh, Pa.

WHEN in search of information relative to the "how" and "why" of doing anything much can be learned by talking with the man on the job. So with this belief in mind I chatted with a blacksmith at a mine on the subject of cutter bits for the chain-type mining machines. He was brimful of constructive criticisms of his trade, which, in the main, is the sharpening of bits, and for all his foreign accent and muddling of the English language he was capable of telling an interesting story:

"What's a matter with em bits, you ask me? I tell you what. You hear me what I say. I know someting bout dis job; used to be machine man myself, las' place I work. Some man he sharpen bits good, some man he sharpen bits bad. Good man he get sick, then bad man he sharpen bits and make machinemans sick. Machinemans swear lika hell. No can cut em places that shift. Night boss he mad too since he catch em hell from 'super' in morning. Maybe company call 'super' too; maybe so.

"See this bit, I sharpen em good this way. Wait; I show you 'nother one. Last blacksmith sharpen wrong and edge break off bye-byes. See; too long and not thick 'nough here. Every man got own way; most of time wrong. I know how because I cut em coal one time; see!"

So I spent nearly a half hour listening to the enlightening explanations of this man, at that time engaged in sharpening bits, but formerly on the other side of the fence cutting coal with a chain machine. He knew both sides of the story, and in his own simple way laid emphasis upon features in the shaping of bits. Many of these form the structure of this article.

Go where you will to the larger mines in the bituminous fields, on the days those mines are being worked you are almost certain to notice that bits for chain machines are being sharpened. Depending upon the hardness of the coal or the impurity and the width of the places, after a machine has made a number of cuts—sometimes two and sometimes as many as five—the bits become worn, and, as a result, cannot cut efficiently.

A dull bit in cutting is injurious to the machine itself and reduces the area which the men who operate it can cut in a shift. The blunt steel, instead of tearing into the coal as it should, tends to rub over its surface.

NOTE—The headpiece shows a blacksmith sharpening bits on a mechanical sharpening machine. The heated bit is dropped behind an anvil block which holds it firmly while a roll die passes over it and shapes it. The air for the forge is supplied by a small blower.

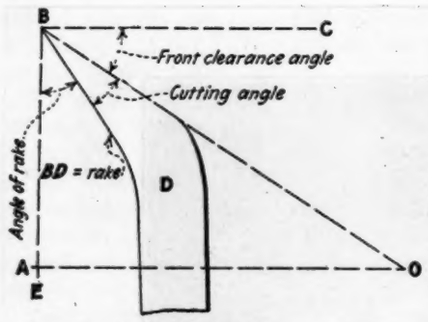


FIG. 1—DESIGNATIONS IN CUTTER BIT DESIGN

In present-day design all the various factors in cutter-bit design are variable. Some standardization would be desirable.

The operative is tempted to load the friction, in consequence of which an overload is placed upon the motor, which will blow its fuses unless the runners have replaced them with copper wire, in which case the armature is likely to burn out. Even if this does not happen an unnecessary strain is exerted on the mechanism of the machine, particularly on the feed chain.

Let it be said here that the runner is tempted to plug the fuse gap with wire of heavy resistance only when his machine is not functioning as it should or when the cutting is difficult. Furthermore, the runner prefers to use an excess of power and injure the coal cutter rather than replace bits, for in his eyes this work is an annoyance and a waste of time. Toward the close of the shift, accordingly he tires of changing bits and is disposed to try to cut an excessive yardage with one setting. Consequently the management should feel under obligation to remove the cause of this evil practice. Supply the runner with well-sharpened bits, and further trouble is likely to disappear.

At most mines bits are sharpened on an anvil or with a power hammer by a blacksmith, who is frequently required to work overtime. He must be skilled in his work; otherwise his bits will not be kept of the desired uniformity. At that, a close scrutiny of the finished hand-sharpened bit will show that no two are exactly alike. When the tip of the bit has been rounded somewhat it can be restored by a few blows of a hammer; but it frequently happens that a portion of the tip is torn off, in which case the steel must be drawn out. This takes time and labor, consequently the blacksmith often is disposed to shirk this part of his work.

But that is not the only objection to sharpening bits by hand. The exactitude with which the bit is shaped is limited by the ability of the blacksmith. The tip may come to a point as in a right pyramid, allowing little or no clearance below the cutting edge. Frequent sharpening of a bit which initially was of the correct shape as to clearance and rake may alter it so as to lower its ability to cut. Choice should be dependent upon efficiency of cutting as well as facility of sharpening.

Ask a machinist who operates a metal-turning lathe as to the theory of shapes applied to his cutting tools, and his remarks will set you to thinking about your own problem. All cutting tools may be considered primarily as wedges driven into the material to separate it. A thin-edged tool cuts more easily because it generates less friction, distorts the chips less and removes them more freely. The edge must be thick enough to make a heavy cut at a suitable speed and have a point of width sufficient to withstand the heat generated by friction. Large roughing tools are round-nosed because that shape provides a longer cutting edge than does a straight-line shape, as notably in a diamond-point or facing tool.

What applies to metal-turning where practices have been developed to a science after years of study and experience should apply also to coal cutting. In the latter case the cutting bits do not overheat, unless a sheet of sulphur or a piece or blackjack is being cut, as the material cut is comparatively soft, and each bit is not constantly cutting coal. Nevertheless, the theory of rough versus fine cutting is equally applicable to either case. We learn from our brother the machinist, therefore, that we must be discreet in our choice of tools for cutting coal.

He could further point out to us, were he to examine our cutting bits and witness our process of undercutting, that may of our bits are poorly designed. They are not provided with the necessary rake, nor do they have the up-and-down clearance which is an extremely important detail of design if friction is to be kept at a minimum.

He has developed his many cutting tools by evolution to the extent that the shop in which he works is equipped with a large number of lathe tools, each of which is meant for some particular job. A specific selection of one tool in preference to another is made only after due consideration of the hardness of the metal, its structure and the rate of cutting, and now he contemplates going a step further by establishing a nation-wide standardization of his tools, which will greatly reduce their number.

He would not expect us to carry our selection of bits to the nicety practiced in his machine shop but he might well wonder why it is that we use the same bit under divers circumstances with little or no regard for the work which it has to be applied. The coal of the many seams mined varies widely in hardness and in structure. Is it not reasonable to suppose, therefore, that judgment should be exercised and a cutting bit of one shape chosen in preference to another for cutting the coal in a given seam? At least should not the tool which is used be of a general design to minimize friction in cutting?

The master mechanic of a large bituminous company hints that managements would do well to see to it that bits are correctly and uniformly sharpened. After wide experience and extensive observation in the problems dealing with correct application of equipment he makes this recommendation—not so much because its fulfilment would effect a worthwhile saving in power as because places would be cut more easily and quickly, so that a single machine would cut more places in one shift and so that the wear and tear on the machine would be diminished, thus reducing maintenance cost by minimizing the frequence of repairs. To convince himself that the power cost in the cutting of coal by machine is a negligible consideration the master mechanic men-

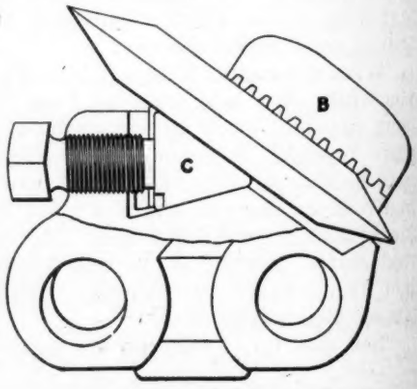


FIG. 2—SELF-SHARPENING BIT

Bit can be turned side for side and end for end, thus affording four sharp cutting edges before it needs sharpening. It cannot work loose.

tioned made a number of electrical tests of power consumption under different conditions. Most important of his discoveries was that the power consumption per square foot of undercut was not so high as to impose an important burden on the costs of operation. Depending upon the coal cut and the type of machine used, the power consumption varied from 22 to 56 watt-hours per square foot. A summary analysis of a particular machine, a Goodman universal shortwall mining machine, shows that it cut an average of ten places per shift. The length of the cutter bar and the width of the room cut were 7 and 17 ft. respectively; the power consumption per square foot of undercut was 23 watt-hours, and 4 kw.-hr. was the average power consumed per place cut, including moving from room to room.

Figuring the cost of cutting (at night) at 1.5c. per kilowatt.-hour, the cost of power to cut ten places was 60c. The power cost for one machine, even where the cutting is difficult, seldom exceeds $1 per shift. At that rate the power cost for undercutting 2,000 tons of coal varies from $6 to $10 and constitutes about one five-hundredth of the prime cost of producing the coal. For this reason we may regard power cost as an unimportant factor as compared with the direct cost of mining.

This point is emphasized in order to set aright those who judge the worth of an improvement in coal-cutting machinery solely by its saving in power. Though a reduction in power consumption is an indication of improvement, we are more concerned with ease and speed of cutting than with power consumption. Cause each machine to cut one additional place, and nine machines will do the work of ten. Reduce power consumption one-half and the saving of itself is small. Cut more places per shift and provide that delays and repairs occur less frequently, then something will have been accomplished. On this fact depends the plea that uniform and correctly shaped bits be used in the cutting of coal.

Though the two general types of bits in wide use are the chisel point and the pick point, their shapes are many, each arising from the individual ideas of the maker. How foolish it would be to use promiscuously any one of the shapes under any one given condition! Of the two types the pick point is that most used. Its shape varies from a needle-like point with squared corners to a round nose having a flat rake and a rounded drag. This last shape can be correctly formed only in the dies of a bit-sharpening machine.

Less power is required to operate pick points, which means that cutting is easier; but in a hard substance, such as sulphur sheets, chisel points are more applicable, because they protect the links and setscrews of the cutter chain from being abraded by the substance they cut. This last objection, however, is ruled out where cutter chains of seven or nine positions are used. In addition to these, several freakish shapes have been tried; some are curved in a prong point; in others the effective cutting edge is turned askew relative to the center line of the bit.

Would it not be well to standardize bits and reduce the number from one hundred or more to a half dozen well-defined shapes? Each shape could be numbered to indicate its adaptability to a coal of a given hardness. Thus No. 1 bit would be suited to very hard coal. No. 6 bit to very soft coal and the intervening numbers to graduated degrees of hardness. This, of course, would lead to the standardization of cutter chains also

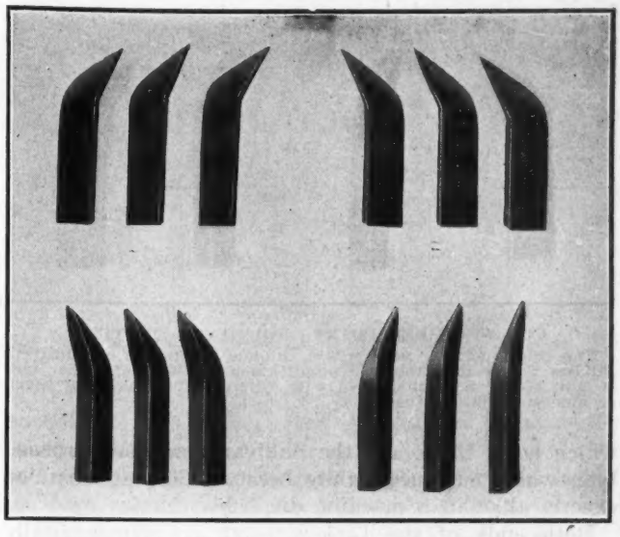


FIG. 3—PICK POINTS FOR CUTTING MACHINE
The pick point is suitable for coal that is easy to cut. It can do the work without becoming unduly heated with injury to the point.

—there is no reason why a standard cutter chain should not be applied to all cutting machines regardless of make.

These shapes could be derived through empirical tests, and the seams of coal being mined in this country could be grouped under six numbers according to their degrees of hardness. No longer would the mechanical man at the mines be in the dark as regards the shape of bit best suited to this needs nor would he experience trouble in making or having the bit made, knowing the shape best suited to his purpose.

There are relations between the angles and dimensions of a bit which affect its efficiency in cutting. Most of these are known by the makers of cutting machines and the rest could be worked out. Thus the smaller the cutting angle (see Fig. 1), the longer is the rake. Sometimes the cutting angle is referred to as angle AOB. In reality it is not, for the angle AOB is equal to the angle OBC, which is the front-clearance angle. To machinists the cutting angle is the angle OBD.

The harder the coal the smaller should be the front-clearance angle, and the softer the coal the smaller should be the cutting angle. The side-clearance angle has practically no relation to the other angles, the dimensions of the bits or the hardness of the coal to be cut. It could be made a constant for bits of all shapes.

How to obtain and maintain at the mine a uniformity in the shape of the bits is not an obstacle. Many intricate forgings are made by machines in other industries, and consequently there is no reason why machine dies could not be designed to make a bit of any shape found desirable.

The carbon content of the steels to be used in making these different shapes of bits could be specified. At the same time methods of tempering each steel could be evolved. Much of the trouble with bits is due to faulty tempering of the steel.

Of the many bits now in use only two might be recognized as standard. The term "standard" as applied to bits in this instance is meant to connote correct shape, which may be maintained uniformly in sharpening rather than universality of use. In this category are the Link-Belt double pointed bits, which owe their efficiency in cutting to the devices of the cutter chain

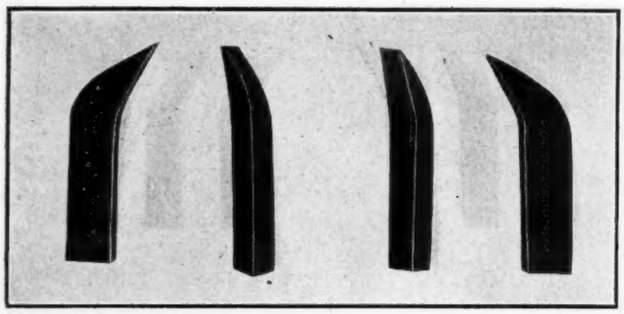


FIG. 4—CHISEL POINTS FOR HARD CUTTING
The chisel point is used where sulphur sheets are encountered. It lasts longer than the pick point, given similar material to cut. It can, however, be dispensed with where cutter chains of seven or nine positions are used.

which holds them, and the Sullivan machine-sharpened bits, which cut successfully because all are sharpened exactly alike in a machine die.

Both ends of the Link-Belt bit are symmetrically pointed. For this reason when the cutting edge of one point is worn, maintaining the same point uppermost and turning it side for side, a fresh cutting edge is put into position for cutting. After that edge is dulled the bit is turned end for end, giving it two additional cutting edges. The designs of the bit and the lug link which grips the bit are shown in Fig. 2.

The bit is gripped in the cast-steel lug link by two bearing surfaces. One of the grips, B, is corrugated and fixed as part of the lug link while the other is a movable wedge, C, which is positioned by a setscrew. The wedge and corrugated grips act in a manner to tighten rather than loosen in cutting. Consequently all bits are held in line as set, and none is lost in the cutting of the coal. Because the cutting angle (term used in the sense of angular position) is obtained by the position of the bit in the lug link, the efficiency of cutting does not depend so much upon the skill of the blacksmith in shaping it as it does with other bits. In the Link-Belt cutter chain the lug grips maintain this cutting angle, which, therefore, is mechanically controlled.

For details regarding the Sullivan bit sharpener the reader is referred to pp. 826, 827 and 828 of *Coal Age*, May 18, 1922. Briefly this machine is a belt-driven, oscillating roll die which draws out the point of each bit sharpened to exactly the same shape. An examination of the headpiece to this article will reveal its working principles. The finished bits are shown in Figs. 3 and 4.

About eighteen months ago a mechanical bit sharpener was installed at a mine which produces 2,000 tons of coal daily. Prior to this time the blacksmith shaped the bits on an anvil and sometimes had to work overtime in order to put a fresh edge on all the bits needed for the next day's run. One set of bits such as he could make by hand would cut no more than three places, whereas a set of the machine-sharpened bits now used will cut from seven to nine places. Repair costs have been lowered as a result.

Surges of current through the motor of a mining machine caused by variations in the load burn out many armature coils. In fact the armature coil in a mining machine is replaced more frequently than any other part. When hand-sharpened bits were used four of five coils burned out each week, but now the number is reduced to one.

Coal-cutting machines have been and constantly are being improved so that today they are both efficient and reliable, but a similar advance cannot be noted in the implement that actually performs the cutting, namely the cutter bit. We see much evidence of inefficiency caused by its shortcomings in general; on the other hand we have some evidence of its efficiency when due regard for correct design is observed. This problem concerns every soft-coal operator and consequently should receive more study.

Anthracite Small Sizes as Competitor of Bituminous Coal for Locomotive Use

Anthracite is consumed by railroads to some extent, the Lackawanna advertising its use in locomotives as a feature not to be overlooked by the traveler who decries dirt and sulphurous smoke. In recent years it is the smaller sizes rather than the much more valuable household coal that gets into locomotive fireboxes. In the April issue of *Baldwin Locomotives*, published by that famous Philadelphia maker of locomotives, is an article on the Philadelphia & Reading R.R. in which are some very interesting figures on the use of small sizes of hard coal in competition with bituminous coal in road service on that road's locomotives.

The figures given below are those showing the relative percentage of each used in several types of service, fast and slow:

NEW YORK DIVISION		
Through passenger service	*Winter*	50 per cent buckwheat, anthracite 50 per cent bituminous
	Summer	60 per cent buckwheat 40 per cent bituminous
Local passenger service	*Winter*	60 per cent buckwheat 40 per cent bituminous
	Summer	70 per cent buckwheat 30 per cent bituminous
READING DIVISION		
Through passenger service		Same as New York division
Local passenger service	*Winter*	65 per cent buckwheat 35 per cent bituminous
	Summer	75 per cent buckwheat 25 per cent bituminous
HARRISBURG DIVISION		
Through passenger service		Same as New York division
Local passenger service	*Winter*	75 per cent buckwheat 25 per cent bituminous
	Summer	80 per cent buckwheat 20 per cent bituminous

A more striking instance of the efficiency of steam sizes of anthracite would be hard to cite. The record of the Reading for operating its trains at high speed, and getting them in on time need hardly be mentioned. The article in *Baldwin Locomotives* adds:

"The selection of these mixtures has been made an object of special study, with a view to combining high efficiency in operation with a minimum charge for fuel."

If the Reading, by mixing buckwheat with bituminous, gets high efficiency at the lowest cost, it would seem logical to suppose that other fuel users, especially those in anthracite territory, could duplicate that experience.

MINERS SAY THERE WILL BE NO SOFT-COAL STRIKE in 1923, so now we can put all our worry on the hard coal.—*Denver Express.*

Mortar Ejected from Cement Gun Protects Roof from Injurious Effects of Mine Atmosphere

Believing That Gunite Had Now Been in Place Long Enough to Reveal Its Qualities, "Coal Age" Requested a Representative to Inquire as to Its Ability to Prevent Roof Falls in Roadways

GUNITE is a mixture of cement and sand with water, projected as a plaster under pressure by a special device for that purpose, known as the cement gun. In the early days of its introduction, a little more than ten years ago, little confidence was shown around the mines in the permanency and value of such thin sheets of cement mortar, though it was recognized that the mixture thus sprayed was much denser than any hand-troweled coating. Its importance today in not only one but in all the heavy industries is justly recognized.

The civil engineer recommends its use in the facing of dams, reservoirs, spillways and ditches because of the ease with which it may be applied, its imperviousness to water and its great strength when reinforced with steel; the chemist recommends its use to protect materials such as metals from the attack of corrosive liquids and gases, and the metallurgist and combustion engineer each has borrowed the principle of applying gunite, in the one case for lining crucibles, retorts, blast, open-hearth and reverberatory furnaces with high-temperature cements and in the other for the repairing of boiler settings.

In the mining industry gunite is saving large sums of money chiefly by holding the roof of entries but also by facilitating construction work in or about the mines. Mining in sedimentary rock formations such as coal and the superincumbent measures has ever been dangerous and uncertain, and consequently any means that will decrease its inherent dangers and reduce the costs of maintaining excavations is of the greatest importance to the coal industry.

Its first accomplishments in coal mines were inspected publicly in 1916 when a group of prominent mining men visited the experimental mine of the U. S. Bureau of Mines at Bruceton, Pa. In this mine gunite had been placed on the surface of about 300 lineal feet of entry at the extreme inner end of an explosion chamber where the causes and effects of coal-dust explosions were being studied. Prior to the visit of this group of men it is estimated that nearly three hundred blasts were exploded in this chamber in the presence of finely comminuted coal. Some of these were of such violence as to crack the concrete lining which had been placed on the first few hundred feet of the entry.

Between the stretches of gunite and concrete was an interval of perhaps 400 ft. where no lining had been placed. Examination of this section revealed that the drawslate above the bibs of coal had been cut to such a degree that the span had been widened and the roof thus weakened. The rock over the roadway had fallen in places to considerable heights. The gunited portions evidenced no signs of slacking except where the coating was less than ½ in. thick. Timber sets, if placed in this entry to hold the roof, would have been dislodged by the first explosion following their erection.

The possibilities of the method were readily apparent. Here was a means of preventing a deterioration of the roof such as is the cause of most falls. Moreover, it would make the roof and ribs proof against fire. It is well known that coal will be ignited by the heat of a short-circuit such as frequently is caused by the grounding of a trolley wire.

They could see that the elimination of timbers along the main entries would make the roadways safer for derailments frequently dislodge timber; that men could travel back and forth with reasonable assurance of protection from roof falls, and that much expense would be saved by reason of the decreased necessity of removing fallen rock from haulageways. It also would make the haulage safer, for derailments are always to be feared where rock falls on the tracks.

This same group of men visited the Mt. Pleasant mine of the H. C. Frick Coke Co., which was one of the first commercial mines in which the roof of an entry was gunited for the purpose of preventing falls of rock. For a distance of 150 ft. adjoining an 18-in. brick arch near the shaft bottom a ½-in. coating of gunite had been applied. Though the thickness was less than the ½ in. recommended, there was no indication that at any point had the gunite broken off or the roof slacked.

From that mine the party went to Irwin to inspect Edna No. 1 mine of the United Coal Corporation. On the day of the visit a fall on the slope of the main haulageway had closed down the mine. This was the most troublesome slope in the region. The bad roof which is so general near the outcrop of the Irwin Basin had been further weakened by the ill-advised methods by which the mine had been operated in its early development, over twenty years earlier. The coal had been extracted on both sides of the slope with little consideration of the needs of the future, the barrier pillars, if

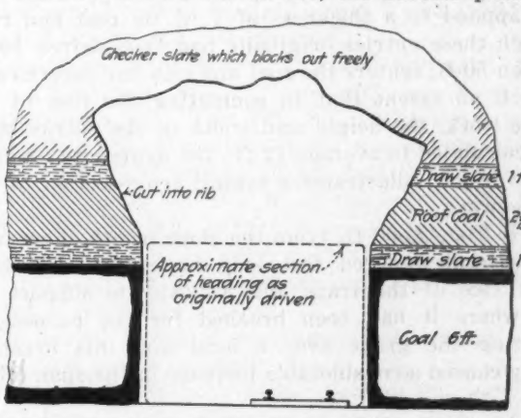


FIG. 1—CROSS-SECTION, SLOPE AT EDNA NO. 1

This slope, located on the edge of the Irwin Basin, kept disintegrating and falling until it reached a height of 12 ft. The coal ribs also spalled and widened till the roadway was 12 ft. wide. It was gunited six years ago and falls are now infrequent. Three trackwalkers used to be employed, and the condition of the slope made the flow of coal irregular. Only one man now is needed, as falls hardly ever occur.

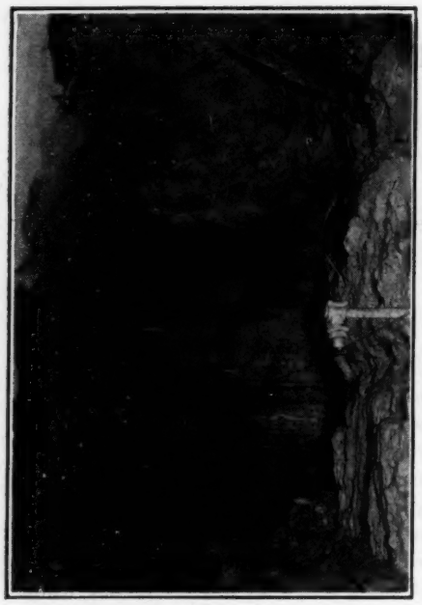


FIG. 2—HIGH PLACE, PITTSBURGH SEAM

The roof is 20 ft. above the rail as the result of continued caving. It has been gunited to render it safe and to make it economical to haul coal beneath it. A rotten sandstone lies above the coal.

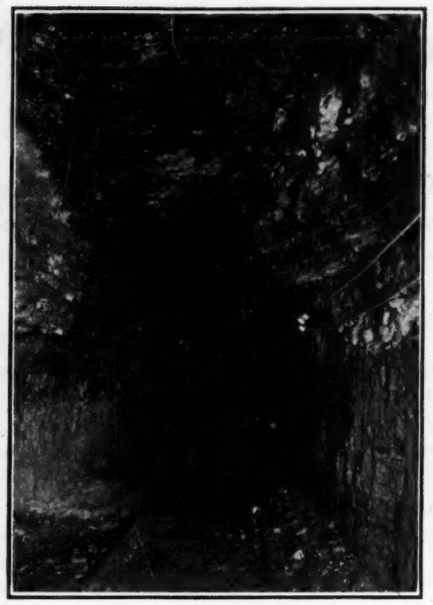


FIG. 3—ENTRY ROOF CUT BY MINE AIR

The sweating of warm, moist, intake air makes the roof wet and subjects it to a weathering process. The changes in temperature also weaken the roof by expansion and contraction.

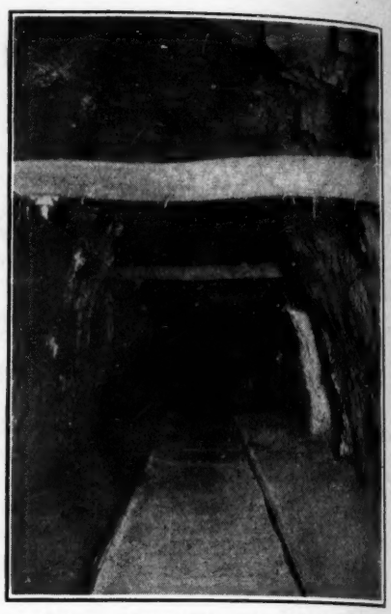


FIG. 4—ROOF SHOWN IN FIG. 3 GUNITED

Both Figs. 3 and 4 show conditions in the Gibson mine of the Hillman Coal & Coke Co. Because this section was wet, it was expected that it would have to be timbered, but the result was as shown.

such they could be termed, left for the support of the roadway being in places inordinately narrow and inadequate for the purpose intended.

The slope is one mile long and consists of a haulageway, a manway and two airways driven 10 ft. wide on 50-ft. centers. It is protected by barrier pillars which vary in width from 100 to 200 ft. Falls along this slope caused the mine to be shut down two to five days each month. The slope was timbered heavily and could be kept open only at great expense. Above the 6 ft. of Pittsburgh coal is a roof of drawslate 12 in. thick. Above that is approximately 30 in. of roof coal separated from a thick checker slate by another 12-in. stratum of draw slate. This uncertain material is overlaid by a solid sandstone.

Soon after this trip of inspection Edna No. 1 mine was acquired by the Hillman Coal & Coke Co., and the timbers lining the slope were removed, the roof and ribs being trimmed of all loose material. Gunite was then applied to a thickness of ¾ in. on roof and ribs. Though these entries originally had been driven 10 ft. wide on 50-ft. centers the roof and ribs had deteriorated to such an extent that in computing the cost of the gunite work, the height and width of the entries were each calculated to average 12 ft., the aggregate totalling 36 ft. Fig. 1 illustrates a typical cross-section of the haulageway.

At B Flat, 2,500 ft. from the slope mouth, a concrete wall several hundred feet long had been erected on either side of the track and walkway to support the roof where it had been brushed for the purpose of adjusting the grade over a local dip, this brushing having caused a considerable increase in the span of the roof.

The worst condition in the slope is found at 3 Flat, 100 ft. in, where the barrier pillar is only 55 ft. wide. In places rooms were driven through to the slope entries so that the ribs afford little protection to the roadway.

A short time ago the writer inspected this slope and found that the gunite had done much to hold this roof in check. The original gunite applied six years ago was still intact in places though it had been patched in spots of small, and sometimes exceedingly large, areas where the roof was heavy and fell. A comparison of the number of falls before and after the placing of gunite is indeed striking.

Prior to the completion of this work as many as three falls occurred daily. Three men were employed as slope walkers, whose duty it was to watch for signs of impending falls, which, when they occurred, inevitably crippled the haulage and decreased production. Today only one slope walker is employed, and he has a sinecure, for last summer in a period of three weeks only one fall occurred. The cost of placing the ¾-in. coating of gunite along this slope was $1.25 per lineal foot, which was 3½c. per square foot.

A consulting mining engineer reports that he witnessed the driving of a slope 400 ft. long through alternate strata of sandstone, shale and clay overlying the Lower Kittanning seam. When first driven the top and sides seemed so hard that it was considered unnecessary to timber the slope except for a short distance near its mouth.

As time went on, however, small pieces of the clay and shale kept falling until the slope became in places both high and wide. Gunite was applied to the top and sides, and though six years have elapsed since the completion of this work there has been no further trouble with the roof except in a small area where a large quantity of water at one time escaped into the roadway and made it difficult to obtain the requisite adhesion of the gunite to the rock.

An account of the guniting of entries in the mine of the Allegheny River Mining Co., Kittanning, Pa., appeared in *Coal Age* Aug. 14, 1919. A few words at this time regarding the permanence of this work will be scarcely out of place, as this company was one of the first to adopt the guniting of its haulageways as a standard practice. A report of its experiences prior to 1919 is reproduced on the next page:

"Along 5,842 lineal feet of headings covered with gunite not a single fall of any consequence has occurred either from the roof or the sides. This is certainly remarkable in view of the contrasting conditions which formerly existed when thousands of dollars were spent each year to clean up falls, to repair dislodged trolley wire, and to rectify other conditions consequent on the weakness of the roof. Timbering to support the entries cost at the rate of $7 per lineal foot, which is a prohibitive figure as compared with the expenditure of 75c. per lineal foot which is all that it has cost to support the roof with gunite."

In a recent statement this company reports that about two miles of entry has been gunited with entirely satisfactory results. The oldest gunite, which was applied five years ago, is holding well, though it must be patched periodically where thin sections have spalled. The average thickness of the coating is estimated to be ⅝ in.

Entries in both the Upper Freeport and the Lower Kittanning seams have been covered with equally satisfactory results. The roofs over these seams disintegrate rapidly, and small pieces drop from them so readily that the entries widen as the roof rises higher and higher. Timbering will not remedy such a condition. Gunite has kept the cross-section of the entries uniform over a period of years. The management specifically attributes its success in holding the sides and roof to an occasional patching of all areas where spalling occurred.

In No. 2 mine of the National Mining Co., near Pittsburgh, Pa., a shaft was sunk to handle the large quantity of slate that falls in the roadways. During the mine workers' strike in a distance of only 1,500 ft. about 1,500 tons of rock accumulated on the "Parallel Entry" leading from this shaft. In the first days following the settlement of that issue approximately 3,700 tons of rock was hoisted up the slate shaft. The weight of this slate was 30 per cent as large as that of the maximum production of coal which could have been hoisted in that period. This "Parallel Entry" was gunited, roof and ribs, immediately following the clean-up, and to all appearances this work has permanently checked further falls from the roof.

Before gunite was applied the top fell so freely that there was a constant fear that some one would be killed or injured from this cause. Two wiremen were employed to traverse the haulageways, totaling one mile in length. They were kept busy replacing the trolley brackets and rods which were continually coming down. In four years' time following the driving of this entry the roof scaled off to an average height of 15 ft. Above the 5½-ft. seam of Pittsburgh coal is an 8-in. band of draw-slate and then roof coal split by two bands of slate and a sheet of pyrite. A "rotten" sandstone 6 to 8 ft. thick is encountered above the roof coal. To make matters worse, coal and other soft strata are found above this fragile layer of sandstone.

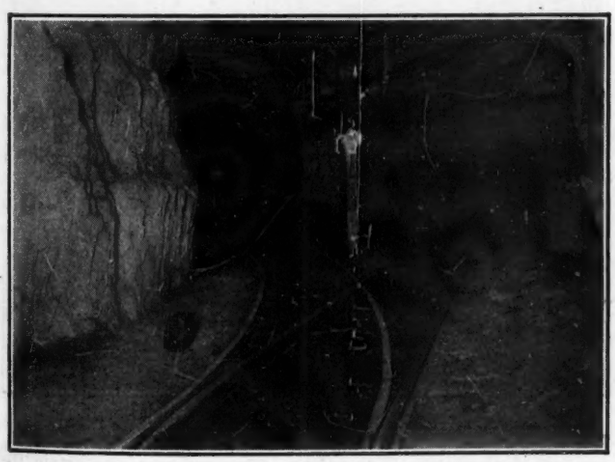


FIG. 5—GUNITE REPLACES STEEL AT TURNOUT

Scene in workings of National Mining Co. Though the span is 24 ft. at the point of the center pillar the roof is holding well as is evidenced by its flatness. Ribs as well as roof are gunited.

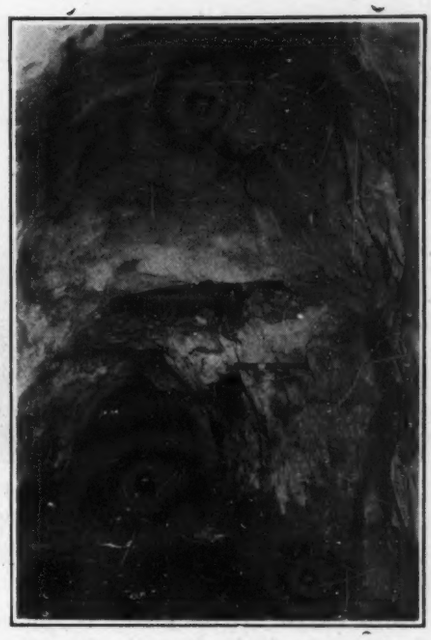


FIG. 6—GUNITE IN WET PLACE

Wolf Summit Mine. Roof falls to the greatest height where the water is most profuse*.

Needless to say, this sandstone could not be prevented from falling after it had been exposed to the air. It broke to considerable heights, as is made obvious by an inspection of Fig. 2, which shows a high place on the empty haulageway. Here a pot has been formed in the sandstone of a depth equal to the thickness of this rock.

The turnout in Fig. 5 widens out from a span of 11 ft. to one of 24 ft. and illustrates a natural condition in a representative mine. Heavy steel beams placed across this span of roof, when properly lagged and propped, would hold this roof temporarily, but the inadvisability of thus supporting it is readily apparent.

To begin with, steel beams would be quite expensive, and, though for a while they would give absolute security, air inevitably would leak through the lagging and loosen the roof material, which would settle upon the beams. In time the load would become so great that it would buckle the steel unless it was taken down occasionally and the load removed.

Conditions in the mine of the Wolf Summit Coal Co., near Clarksburg, W. Va., are different from those already described. The 8-ft. Pittsburgh seam is very friable and acts somewhat in the manner of a checker shale, so that timbering will not hold it in place along the entries, even where 2 ft. of the coal is left in the roof. The coal thus left is of equal quality with that extracted and one naturally is led to wonder why all the coal is not taken out at the same time and gunite almost immediately applied.

The answer is that a smooth slate, resembling a soapstone, and which weathers freely, lies directly above the seam, and if all the coal is taken out the roof begins to fall immediately, pieces weighing as much as 6 tons detaching themselves from the roof a few days after the

*Even in wet places with patience and skill gunite can be placed and will stay. In Fig. 6 may be seen the seep pipes inserted in the roof. After the pipes and the necessary rods were placed the gunite was worked inward toward them. The exposed coal on the right rib was trimmed to line up the trolley wire and is not the outcome of spalling.

FIG. 7—UNTRIMMED ENTRY IN WOLF SUMMIT MINE

The roof appears to be neatly corbeled from the ribs outward, but unless the overhanging material, which happens in this case to be coal, is trimmed from the roof and rib to the left, the gunite will crack after application. The left rib should be trimmed to look like the right rib.

coal is mined. If the gunite is applied to this slate as far away as 80 ft. from the face, the shock of a blast in the coal will dislodge the green gunite.

Yet despite the unusual difficulties, a few of which already have been explained, gunite is applied to the roof and the sides of the headings. Coal left in the roof in the driving of headings soon begins to break loose, the coal corbeling out over the roadway along each rib (see Fig. 7). This has to be trimmed before gunite can be applied. It is difficult to know whether any given portion of the entry has been properly trimmed, for it is impossible to judge just how much of the overhanging coal has been strained and its cohesion destroyed. Then also in some places large quantities of water are encountered (see Fig. 6). Under such circumstances the cement-gun crew has trouble in making the gunite stick.

In spite of the adverse conditions and in face of a bad sweating season last summer, during which time the mine was shut down by the strike, the roof was held by the gunite, so that after a year's idleness the mine resumed operation without a single fall having to be removed. The company believes that if the entries had been timbered it would have had to clean up all the headings. It bases its belief upon the experiences in a neighboring mine which is timbered and not gunited and from which large quantities of rock were removed before a resumption of mining.

The slacking or cutting of the sides and roof on fresh-air entries is most pronounced during the warm months of the year when the humidity in the air is condensed by the cool roof and ribs. Similarly, but in an even greater degree where mines are humidified with steam during the winter months, the roof if weak will slack and even fall in large masses. The Winding Gulf Colliery Co., of Winding Gulf, W. Va., met with such an experience and decided to apply gunite to the ribs and roof. Though this work was completed five years ago, the coating in the main is sound, requiring patching only occasionally at points where portions have fallen.

The material above the coal in most workings is not so weak as in the Wolf Summit mine and has strength enough to support itself when the roadway is driven, but the variation in temperatures of the ventilating air sets up stresses in the outer surfaces of the roof and ribs. Often the intake is so cold as to freeze the water which the roof contains. Moisture also is deposited on the cold surfaces during the sweating seasons and certain constituents in the rock oxidize.

Most of the moisture is deposited on the intake airways so that when the air reaches the return it is less humid and its temperature is more nearly that of the roof and ribs. Consequently falls on the return airways are less severe than on the intakes. It would seem advisable to exclude the air and moisture from the top and sides of entries. This may be accomplished by the use of gunite. Under most circumstances it will perform the duty assigned to it much more effectively than timbering and at a much smaller initial cost. Though easily applied it possesses the merits of being more permanent than timber and maintainable with less labor.

To say that gunite is a panacea for bad roof under all conditions would be an overstatement of its value. In making recommendations to one of his friends regarding the cement gun an operator intimated that there was no doubt that gunite will hold the roof in a mine where falls are caused by a deterioration in the roof due to the action of the atmosphere and not by inherent weakness in the roof, rock strains due to mining or gas pressure. This leads to an important consideration.

The Pittsburgh and the Freeport seams in the Pittsburgh region are known to be topped over limited areas with unusually bad roof, under which steel timbering will buckle and give because of the enormous loads which it must carry. Occasionally in driving into new territory gas pockets above the headings burst intervening rock and cause huge falls. Roof in stretches of 1,000 ft. or more are known to come down over night in an almost continuous line, the breakage extending several feet above the coal. This happened only recently in a mine working the Lower Kittanning seam. In such rare instances the logical solution is to let the roof come down, for usually it will fall to a certain height and then stop, after which gunite may be used to check further deterioration.

On haulageways, above all places, men come and go

FIG. 8—TOO THIN A COATING OF GUNITE

A glance at this illustration will convince anyone that the gunite coating of these ribs is too light. The roof and ribs retain the rough and jagged appearance of the original surface, which would not be the case if the gunite has been used less sparingly. With a better coat the cavities would have been filled and the entire surface rounded.

FIG. 9—SPALLED AREA NEEDS PROMPT PATCHING

Directly above the mine locomotive a large spalled area can be detected in the roof. The air has worked its way behind the gunited material through the exposed edges and caused the development of a large crack above the foremost trolley beam. The ribs also are beginning to spall, the coating being too thin. Where ½ to ¾ in. coat is used no trouble is experienced. Pressure of gas had caused many falls in the roadways before the gunite was introduced.

so often that protection against falls should be provided where the roof is known to be weak and treacherous, but if steel sets are used as supports and it is found that they sag under the roof they are intended to hold, they should not be employed except perhaps at shaft landings and turnouts. Would it not be better to support bad stretches of roof elsewhere by wood timber sets instead of steel, relying on them until it is clear that the load is becoming excessive? They then could be pulled down and the loose rock be allowed to fall, and other rock that is relatively loose could be barred down. Gunite then could be applied with some assurance that the difficulty thus met would not recur. In most cases the use of gunite in the first instance would make timbering entirely unnecessary.

Coal Mining Shown to Be Safe Occupation

UNDERGROUND coal-mining is safer than window cleaning, carpentry, running farm machinery, house painting and more than one hundred other occupations, according to figures made public May 9 by the Bituminous Operators' Special Committee, of which J. C. Brydon, of Somerset, Pa., is chairman. To determine the danger in coal-mining compared to that of other occupations generally considered less hazardous, Mr. Brydon pointed out, the State of Indiana was chosen as the most representative. The National Council of Workmen's Compensation Insurance fixes the rate at $3.55 which an employer of underground coal-mine labor in Indiana must pay per $100 for his payroll.

Compensation rates for underground miners in the different states, Mr. Brydon explained, vary from $2.50 per $100 payroll in Virginia to $5.60 in Illinois, while in more than two-thirds of the states the rate is between $3 and $4. Indiana, with a rate of $3.55 per $100 payroll, approximates the average for this type of insurance in all coal mining states.

"Merry-go-round and roller coaster employees," Mr. Brydon said, "are considered by Indiana insurance men as more liable to injury or death than underground coal miners, as shown by the rate of $5.85 per $100 payroll as against the mining rate of $3.55. Mining in nearly every other form, quarrying and excavating are considered more dangerous than coal-mining, the figures show.

Besides being a comparatively safe occupation, Mr. Brydon stated, underground coal-mining is carried on under more pleasant working conditions than occupations calling for higher insurance rates and less pay to the worker. In most Indiana mines the temperature winter and summer remains virtually the same; in one mine, for example, the temperature remaining within one point of 69 deg. the year round.

Although there are at least 100 occupations in Indiana, which is fairly representative of the United States, classed as more dangerous than coal mining, Mr. Brydon asserted that few if any of workers in these extra-hazardous callings receive a day-labor wage even approaching $7.50 a day, the minimum received by the underground day laborer in unionized fields.

The relative risk of each occupation may be estimated by comparing its insurance rate with $3.55, the Indiana underground coal-mining rate. The list, in part, follows:

Occupation	Base Rate per $100 Payroll
Cattle dealers	$3.57
Veterinary hospital employees	3.57
Drilling or dismantling oil wells	3.58
Bottling	3.61
Wood preserving	3.84
Drop or machine forging	3.84
Manufacturing chains, tools or hardware	3.84
Manufacturing shoddy	3.88
Erection of mausoleums or monuments	3.88
Painting signs on buildings	3.90
Erecting awnings and tents	3.90
Hanging flags and bunting for conventions and celebrations	3.90
Erecting advertising signs	3.90
Manufacturing carbonic-acid gas	3.98
Construction of electric light and power lines	4.01
Installation and repair of boilers	4.36
Manufacturing veneer	4.37
Scaling boilers	4.42
Erection and repair of elevators	4.65
Cotton ginning and compressing	4.77
Operation of electric light and power plants	4.89
Manufacturing cotton wadding and waste	4.91
Garbage reduction or incineration	5.31
Employees of horse sales stables	5.79
Ice harvesting and storing	5.84
Employees on merry-go rounds, roller coasters, etc.	5.85
Manufacturing cottonseed oil	6.21
Cleaning outside of buildings	6.27
Pile driving for foundations	6.52
Raising or moving buildings	7.41
Junk dealers, in shops or outside	7.99
Erecting blast furnaces	8.21
Metal stamping	8.24
Wrecking buildings or salvaging after fire	9.64
Window cleaning	12.09
Workers on rigging, not on vessels	14.91
Erecting scaffolds	16.10
Erecting iron and steel structures	16.10
Painting steel frames and bridges	16.10

Output of Coal on Public Lands in 1922 Double That of Previous Year

Production of coal upon public lands during 1922 more than doubled the output of 1921, according to figures recently issued by the Department of the Interior.

The number of mines that were operated upon public lands totaled 101 in eight Western states. Of these states the largest number of operations were in Wyoming and Colorado, each having twenty-eight mines. Wyoming, with an output of 390,000 tons, produced more than one-half of the total amount of coal from government lands. Colorado, with 165,000 tons, ranked second; North Dakota, with 67,000 tons, was third, and Utah, with 61,000 tons, was fourth.

Production of coal from government lands, by states, for the years 1921 and 1922, was as follows:

States	Mines Producing in 1922	Tons of Coal Produced 1921	1922
Colorado	28	13,096	161,546
Montana	20	3,533	5,454
New Mexico	4	2,816	14,009
North Dakota	8	27,710	66,924
South Dakota	2	.....	424
Utah	9	9,622	60,809
Washington	2	5,175	49,243
Wyoming	28	300,221	390,763
	101	362,173	752,172

Cambria Steel Co. Finds That Good Housing Increases Output*

By George Atwell Richardson
Cambria Steel Co., Philadelphia, Pa.

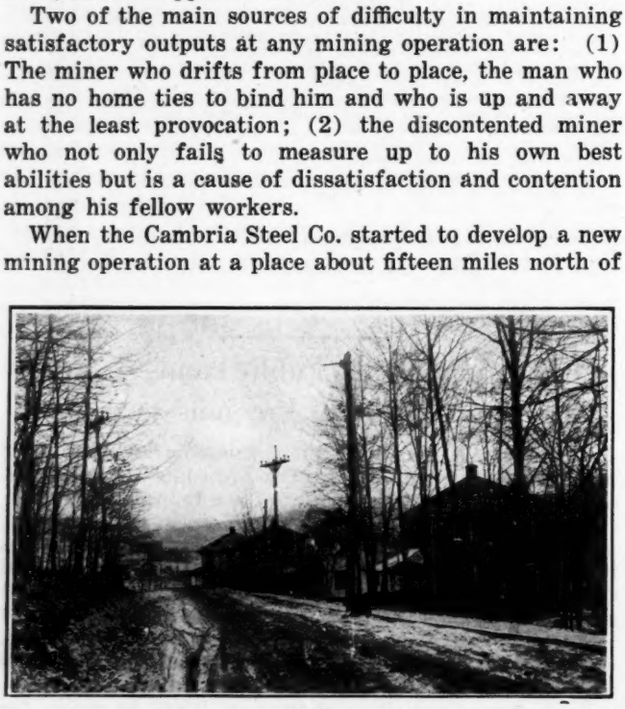
Well-Planned Residences with Modern Comforts in Village of Slickville Lower Turnover and Promote Contentment—Plans of Houses Already Constructed—Sewage Disposal—Many Houses Have Bathrooms, Running Water and Toilets

NO MAN is thoroughly contented unless he has a pleasant and happy home life, and the frame of mind of his wife, if he is married, is an important factor in attaining this condition. It is difficult to remain cheerful and good-natured if one's life partner is always nagging and complaining.

The average woman is not naturally ill-tempered. As a rule some extraneous cause is at the bottom of the difficulty, and no more fertile reason can be found than that of indifferent or bad housing accommodations. Give a woman a good home, and the foundation, at least, of her happiness has been laid.

Two of the main sources of difficulty in maintaining satisfactory outputs at any mining operation are: (1) The miner who drifts from place to place, the man who has no home ties to bind him and who is up and away at the least provocation; (2) the discontented miner who not only fails to measure up to his own best abilities but is a cause of dissatisfaction and contention among his fellow workers.

When the Cambria Steel Co. started to develop a new mining operation at a place about fifteen miles north of Greensburg, Pa., on the Turtle Creek Branch of the Pennsylvania R.R., it recognized these conditions and all plans were based on providing, first of all, really good housing conditions for its workers, a policy which has been fully justified by the results.



FOREMEN'S HOUSES ON APOLLO ROAD

It will be noted that care has been taken to leave enough trees to give the village an appearance of long establishment and the setting which every house needs. The houses are fully provided with plumbing fixtures.

The town of Slickville dates from the year 1916, at which time the town site was laid out, the 1,200 acres comprising the company's holdings having been acquired about 1900. The surveys were made in June and July, 1916, and the first mine opening was made in the autumn of the same year. At that time no railroad had been constructed to the property to be developed, so temporary buildings were erected for housing the employees.

All plans were based on the needs of a mine capable of producing about 3,000 gross tons of coal per day, this being the present capacity of the tipple, though from time to time the output has been increased to 3,100 gross tons. The Pittsburgh seam, the thickness of which on the Cambria property averages about 84 in., lies close to the surface in this locality, and at some near-by mines the coal is removed entirely by stripping. At Slickville, however, most of the work is underground; only a small area has been stripped, about 3,000 tons of coal having been thus obtained.

It was intended to bring the project to rapid completion and the work was expedited as much as possible. The only obstacle was that due to a lack of labor which was even then severely felt, though the United States at that time had not become a participant in the war.

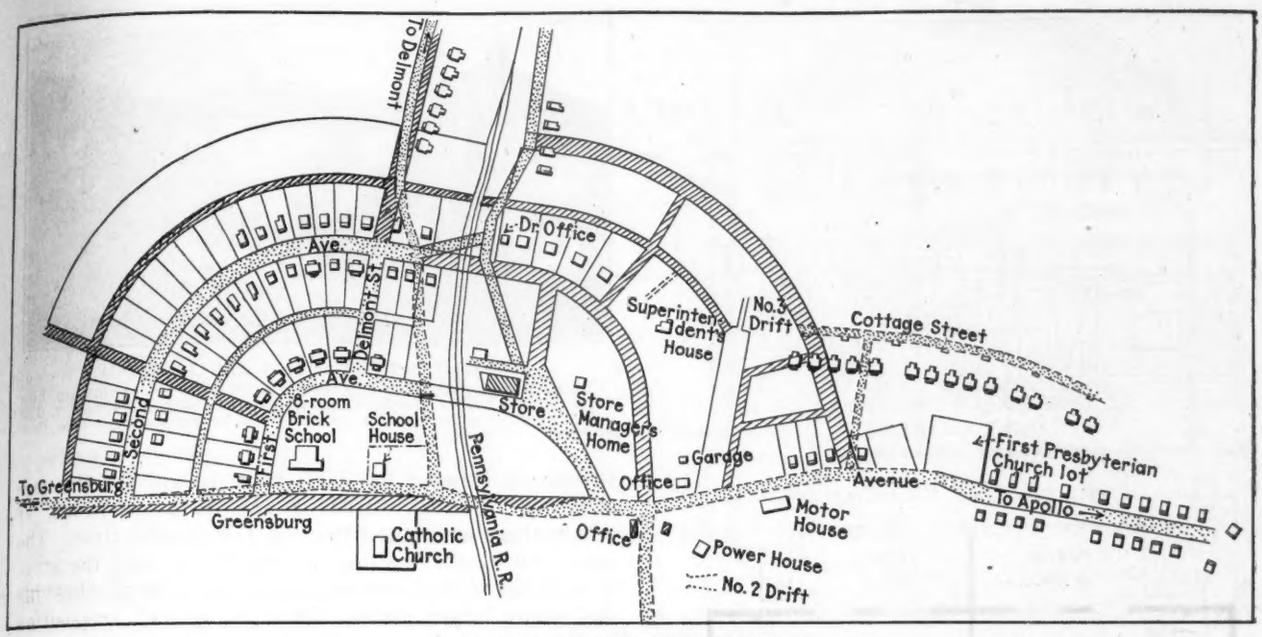
At the present time about 500 miners are employed at the mine, making the total population of Slickville about 1,200 to 1,500. The plan of the townsite, which forms a part of this article, shows the houses and buildings which the company has constructed.

All the houses are of frame construction and of the "ready-cut" type. The erection of the first permanent dwellings was started in 1917, at which time the nearest railroad connection was Saltsburg, five miles away. Material for ten double houses which made room for twenty families was hauled from this point.

These double houses which measure 24x40 ft. exclusive of porches, are provided with two stories. On the first floor of each side are a large living room and kitchen and on the second floor are three bedrooms of fair size which have plenty of closet space. Bathtubs are provided and provisions made for the supply of

*Since this article was received the Cambria Steel Co., as also the Midvale Steel & Ordnance Co., with which it was affiliated, has been merged with the Bethlehem Steel Co.

NOTE—Headpiece shows houses of foremen and mine bosses on the road to Apollo. These have the Sanisept system of sewage disposal. Houses measure 22x25 ft. exclusive of porches. Trees, lawns and flowers give to the houses an air that private ownership alone is believed to confer.



PLAN OF VILLAGE OF SLICKVILLE

The stippled areas show the roads as at present used. An effort has been made to avoid long, straight lines, which are monotonous and none too sightly. Nearly every lot has its service lane at the back so that coal can be stored in the rear of the lot. The road from Greensburg to Apollo runs through the village approximately due north.

hot water. These houses have outhouses provided with concrete vaults.

It is interesting to note that all the houses on the First Ave. circle were built under wartime conditions when there was a great shortage of labor. As a result it was necessary to bring the men out of the mine to complete them, and even the blacksmith took a hand in the work. Hence it can be said that much of the town is self-built.

In 1918 twenty single two-story houses, each measuring 22x22 ft. were erected. All of these are on Second Ave. A living room and kitchen on the first floor and three bedrooms on the second floor is the standard arrangement. A bathroom also is provided on the upper floor.

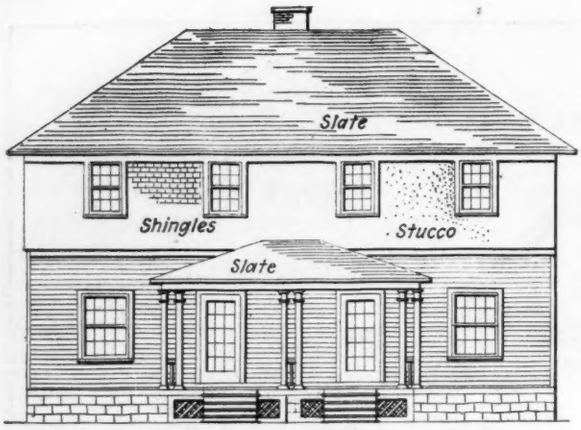
Another group of houses similar in every way to those built in 1918 except that the dimensions are 22x24 ft. were constructed in 1919 for the use of the foremen and mine bosses. It was still necessary to haul material for this third operation over the public roads, but by this time the railroad was within three miles and shortly thereafter entered town, so that the necessity of hauling material long distances no longer hampered construction. All the houses built in 1918 and 1919 were provided with the Sanisept system of sewage disposal.

The year 1919 marks the beginning of the period in which the village began to take on the semblance of a completed town. In this year a large modern brick store building was erected. It is owned by the Cambria Steel Co., but is leased to and operated by the Miners' Supply Co., a stock organization. A complete line of groceries, general merchandise and meats is carried, and the store is provided with its own refrigeration plant. Here also is located the post office, which was raised from fourth class to third class rating in July, 1922.

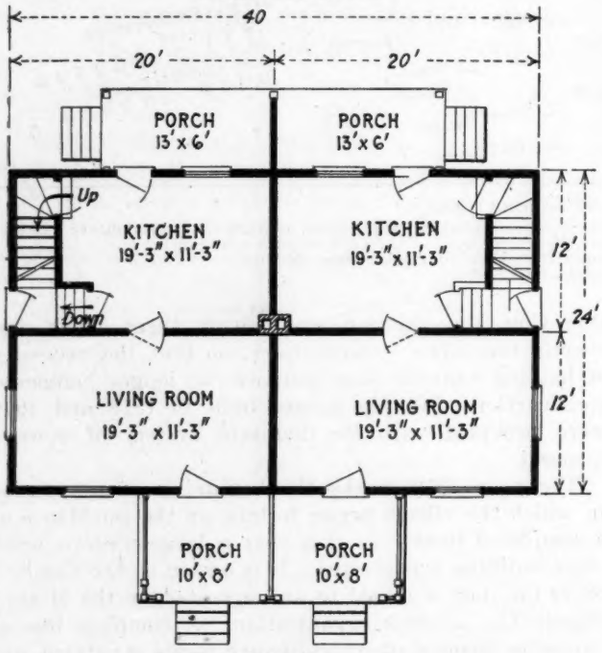
The store is operated on a strictly competitive basis, the appeal to customers being based on the cleanliness of the surroundings, the completeness of the stocks and the low prices. It always has been well patronized,

Double Houses

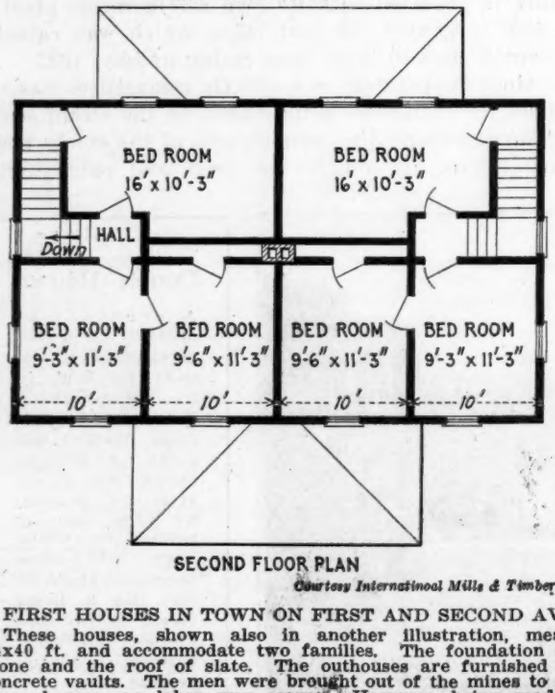
A crescent of double residences on First Ave., taken from the hill in front of the school. The tenants in these houses pay only $7.50 per month for rent, $1.50 for electricity, $2 for coal and nothing for water. Each half house measures 24x20 ft. and has a living room, a kitchen, three bedrooms, bathtubs and water heaters.



FRONT ELEVATION



FIRST FLOOR PLAN



SECOND FLOOR PLAN

Courtesy International Mills & Timber Co.

FIRST HOUSES IN TOWN ON FIRST AND SECOND AVE.

These houses, shown also in another illustration, measure 24x40 ft. and accommodate two families. The foundation is of stone and the roof of slate. The outhouses are furnished with concrete vaults. The men were brought out of the mines to build these houses, as labor was scarce. However, being ready-cut houses about all the qualification the men needed was to know how to drive a nail.

SINGLE HOUSES ALONG APOLLO ROAD

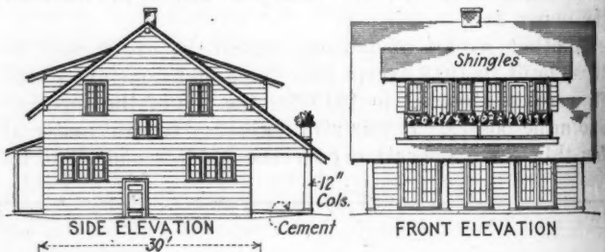
These houses rent for $10.50 a month, clearly exhibiting how little of the mine workers' earnings is devoted to rent. The urban worker often spends as much as 30 per cent on this item alone.

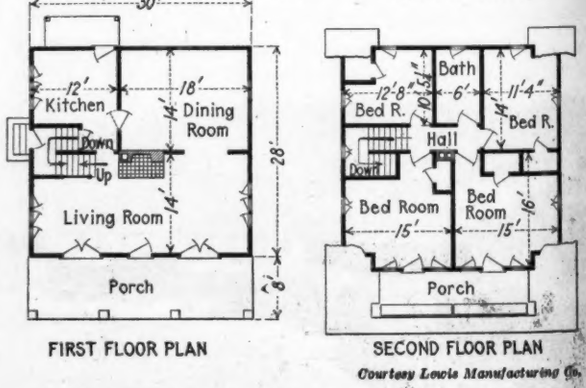
though no attempt has been made to prevent the construction of rival stores or like accommodations, of which there are some fifteen at the present time. The aim is to handle the best of everything, and the store is a credit to any community of the size of Slickville and many larger places. It is a "going" proposition in every sense of the word and pays a reasonable return on the investment.

In 1919 provision also was made for the housing of the various mine officials, a number of dwellings of better grade being erected in a westerly direction from the store. These measure 28x30 ft. and have seven rooms and bath. Individual garages also are provided with each house. The superintendent's house is of slightly different design but the same general type.

In 1920 a fourth group of twenty single houses, each containing four rooms, was erected. These have no bathroom but are provided with running water and with a toilet on the back porch.

The fifth and last group of houses built to date was erected in 1922 more or less as an emergency. These houses are all five-room one-story single houses and are not provided with an inside water supply. One hydrant between each two houses provides the tenants with



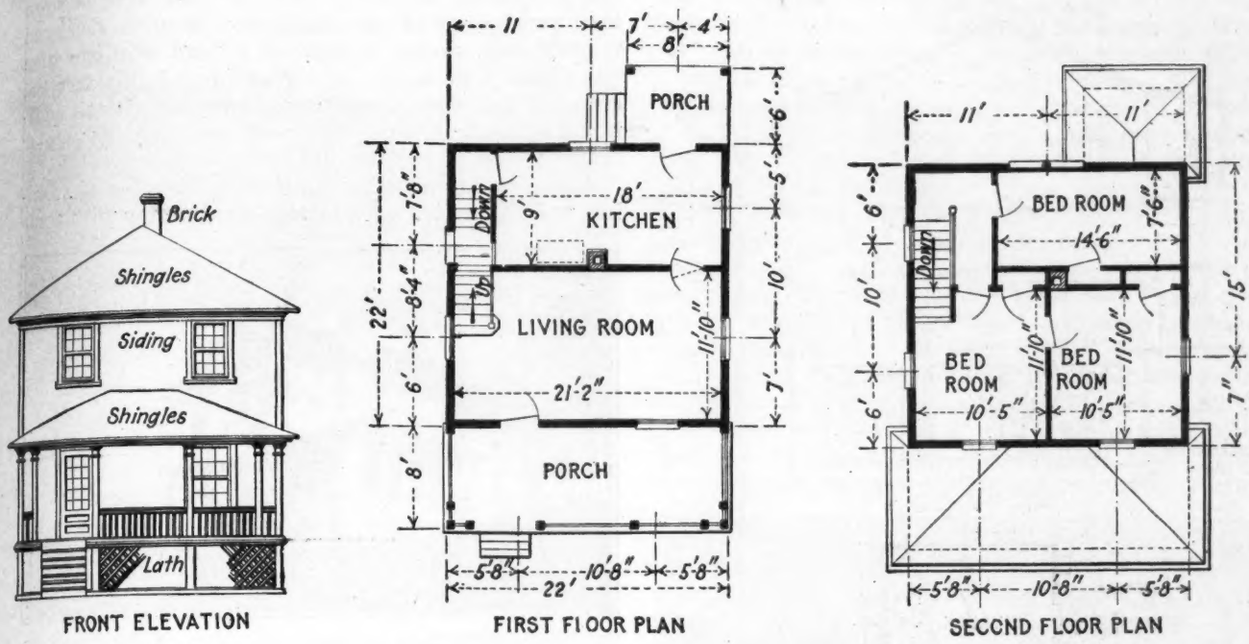


FIRST FLOOR PLAN SECOND FLOOR PLAN

Courtesy Lewis Manufacturing Co.

SEVEN-ROOMED HOUSE FOR MINE OFFICIALS

These lie to the north of the store, that is to the right of it in the plan. The upper floor has four bedrooms and a bathroom. The rooms have plenty of closet space. Each house has an individual garage.



SINGLE SHINGLED HOUSES ON SECOND AVE.

These houses have 7-ft. cellars with 12-in. walls. Similar houses, but measuring 22x24 ft., were built for firemen and fireboses. In all these houses the Sanisept system of sewage disposal has been provided.

water. The outhouses are fitted with concrete vaults. An inside water supply was not provided because it was feared that owing to the type of construction the pipe would be likely to freeze. Six of these houses are located on the road to Delmont at the west side of town, and the remaining fourteen, on Cottage Street in the northwestern part of the village.

SPECIALLY DESIGNED RESIDENCES FOR OFFICIALS

These were erected in 1919, when the railroad was being finished. They measure 28x30 ft. and contain six rooms and bath. They rent for $15 a month.

All the houses are lighted by electricity, the company furnishing the current. The steel company also supplies the coal used by the tenants. Every effort is made to keep these residences in the best of condition, the company keeping a plumber on the job whose duty it is to take care of all minor troubles. Likewise whenever necessary a carpenter is provided to make needed repairs.

The rental of the houses is quite reasonable. No attempt is made to make the investment profitable, the feeling being that the main reason for their existence is to provide housing of such a character as will form an invaluable asset to the mining operation. Indirectly the houses do pay for themselves, because contented help makes for better work. All rentals are figured on a base price for a given type of house plus a flat charge of $1.50 per month for light and $2 for coal. An idea of the low cost can be gained from the figures in the table herewith.

HOUSE RENTS IN VILLAGE OF SLICKVILLE, PA.

Type of House			Rent per Month
Double houses, built 1917	One side	Base	$7.50
Single houses, built 1918		Base	9.00
Single houses, built 1919		Base	10.50
Single 4-room houses, built 1920		Base	8.00
Single 5-room cottages, built 1922		Base	6.00
Officials' houses		Net	15.00
Superintendent's house		Net	25.00
Store manager's house		Net	25.00

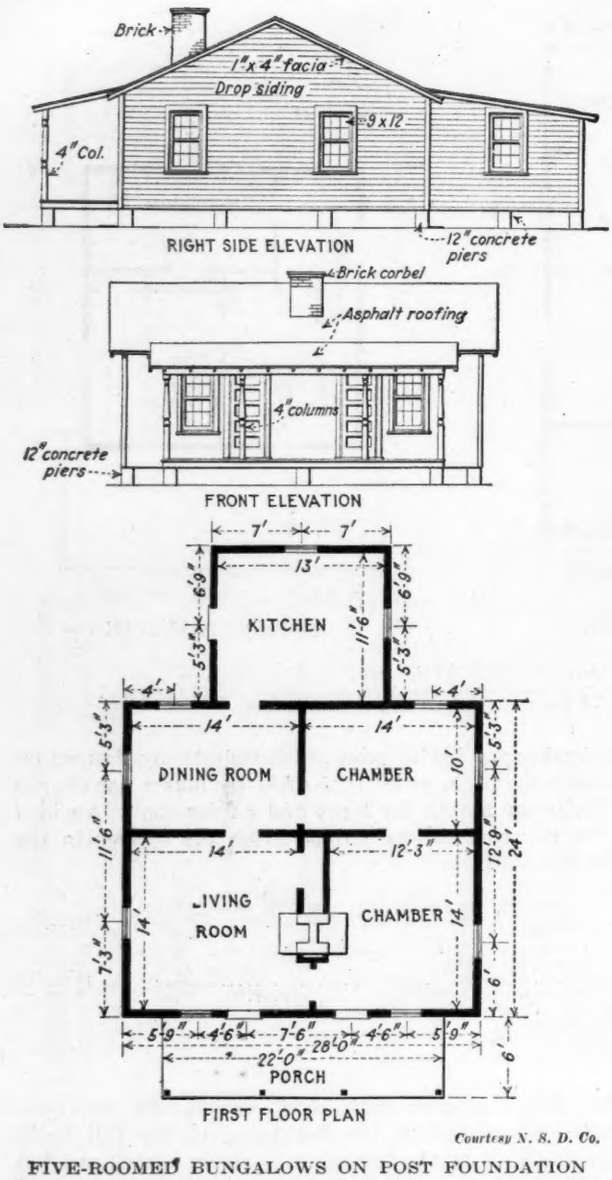
In 1922 a modern eight-room schoolhouse was completed and opened at the beginning of the fall term. This was built by the township, is steam heated and has its own Sanisept sewage disposal system. At the time the school was opened the old two-room structure previously used was abandoned and bought by the Cambria company, which refitted it as a bunkhouse for floating help and provided it with a shower bath.

At the present time there are two church organizations, both active. The Roman Catholics completed a church structure in 1920. The Presbyterians have a lot selected on which they plan to build in the near future.

Other company buildings include the doctor's office, a one-story brick building located close to the railroad station at one end of the row of officials' houses, and the company office. This latter is a two-story brick building which houses the various executive and engineering offices and also contains a jail in the basement.

Village Has Not Been Incorporated

Slickville as a community is directly under the management of the Cambria Steel Co. It is not an incorporated town or village and there are no local officials. Despite this, however, the attitude of the company is not paternalistic but rather co-operative in its nature. No attempt is made to interfere with private initiative of a legitimate character, as has already been evidenced



Courtesy N. S. D. Co.

FIVE-ROOMED BUNGALOWS ON POST FOUNDATION

These houses, which were erected in 1922 to meet an emergency, have a living room, dining room, kitchen and two bedrooms. An outside hydrant provides water for two houses. The outhouses have concrete vaults.

to some extent in the mention of the general store and its competitors.

A well-defined scheme of welfare work has never been planned or attempted. When the town was started the war interfered with activities of this character, and since that time the feeling has been that it was not needed. The company, by furnishing good houses and maintaining them, has stimulated a sense of pride in the residents and encouraged it by co-operation in other ways which do not impose on the independence of the individual. From the results obtained this policy has been more than justified.

A few of the things that the company actually does are as follows: (1) All the lots are provided with gardens. The company plows them and furnishes the necessary manure from its stables. On the whole, good care is bestowed on the garden plots and this effort is fully warranted. (2) The company backs a boy-scout troop which at the time this article is written has a registered membership of thirty-nine. John D. Martz, principal of the school, is scoutmaster and has a fine group of interested boys. Work of this kind is more than worth while in any community, but to be developed to its fullest extent it requires a head who can give lots of his time to it. In recognition of this fact the company has made a practice of allowing a small additional stipend to the principal over and above his regular salary which is paid by the community.

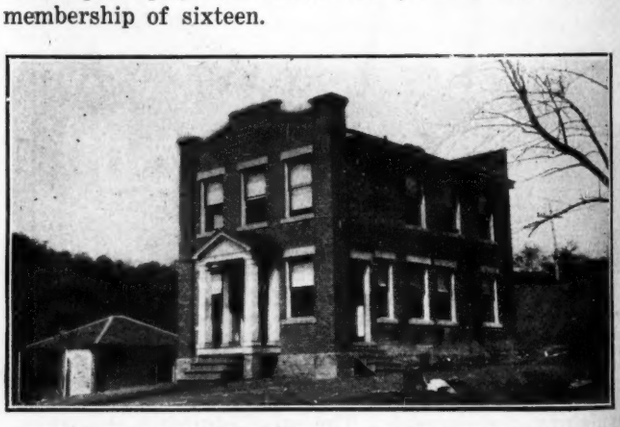
Almost everyone today recognizes the value of scouting, and the writer, as a former scoutmaster with some

RESIDENCE OF THE SUPERINTENDENT OF THE PLANT

This house rents for $25 a month. Where houses are erected for profit and are located near urban centers but still in more or less open country, the rent of such a house as this would be at least three times as high.

six years of experience, desires to emphasize the fact that in his opinion there is no single activity that has to do with boys that is more productive of lasting results. Even at times when those who are interested fear that their efforts have failed, an accidental discovery will show that this conclusion is fundamentally unsound, and in some instances the reaction is of a surprising nature.

The girls have not been overlooked, and a girl-scout troop under the leadership of Miss McKee, a teacher in the school, who is assisted by Miss Martz, a daughter of the principal, was started this year and now has a membership of sixteen.

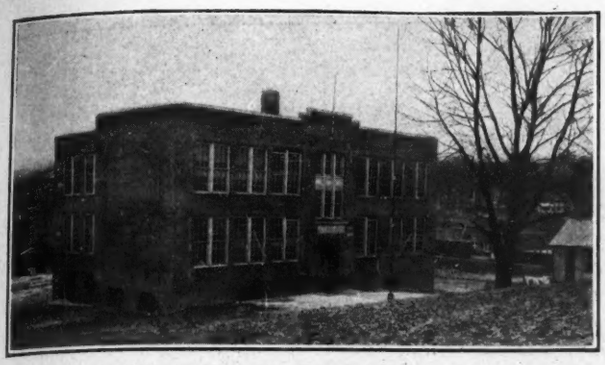


OFFICE OF CAMBRIA STEEL CO., SLICKVILLE, PA.

This two-story brick building houses the various executive and engineering offices. The sheriff maintains a jail in the basement.

Recently both girls and boys were given a chance to show the value of their training when the school directors' meeting of Westmoreland County was held at this place. The ladies prepared the meals in their homes, and the youngsters aided in delivering, serving and handling with great success.

(3) *Safety Work.*—A large proportion of the safety work is handled directly through the schools in the belief that the fathers can be more easily reached in this



EIGHT-ROOM BRICK SCHOOLHOUSE

Large, well-lighted school replaces the old two-room structure that served the community prior to, and for a time after, the opening of the Slickville mine. It also has a private system of sewage disposal.

way. As a rule the children can advocate safety to their parents better than any outsider.

Many activities are carried on independently. Among these are a basket-ball team. Moving pictures are shown three times a week and there is also a dance hall.

The general result is that here is a small mining town where living conditions are particularly favorable to contentment. It is not too far away from a large town (Greensburg, the county seat), and the local surroundings are far better than can be found in many similar places. The locality is an attractive one, in the midst of a wooded, hilly section, and the streets of the town in summertime are particularly attractive because of the many trees which have been left standing.

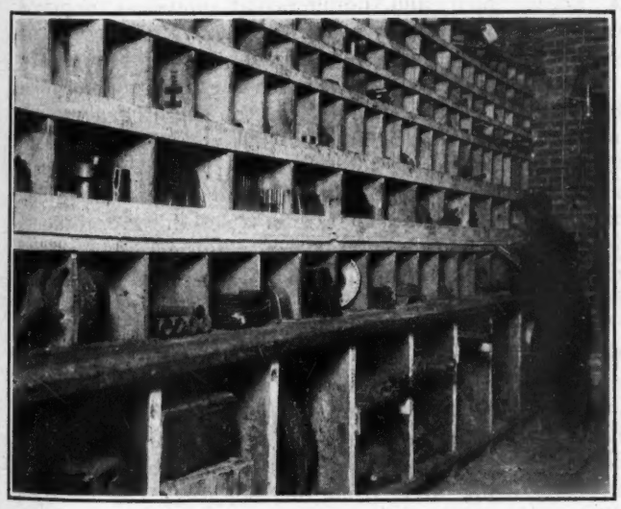
The miners themselves like the place, and few seem disposed, after once they have moved in, to continue to follow the impulses of their roving natures. Even during the recent strike, when, after a long time, it finally became necessary to terminate the leases of some of the miners who refused to go to work, there was no hard feeling, and the same men have since been hired again. In connection with this description of the town of Slickville it will undoubtedly be of interest to know something about the character of the mines and their operation.

This is a typical drift-mining operation with three openings at the present time, the coal being dumped over one tipple. Owing to the position of the seam much of the coal to be mined is what is known as "crop coal" and much timbering is required. In some places it will be necessary to resort to stripping. The roof consists of a rooster coal which in places is 18 in. thick and at other places entirely absent, giving place to slate. Over this is about 18 in. of banded coal and slate and over that again a real slate and limestone. Under the coal is a 4-in. layer of fireclay resting on a hard limestone.

Electricity is used throughout the mine and property, power being furnished from the West Penn Power Co.'s line. A combination transformer and motor-generator station takes care of all requirements. All electrical equipment on the tipple is driven by 220-volt alternating current which is transformed from 2,200 volts. All the mine equipment is actuated by 250-volt direct current from the motor generator. In addition some current is transformed to 110-volt alternating current for use in the town, thus making possible the use of standard electrical devices in the homes. For night work in the mine a small motor-generator set takes care of all requirements.

SLICKVILLE HAS ITS TROOP OF BOY SCOUTS

John D. Martz, the principal of the school, is scoutmaster and has a group of thirty-nine greatly interested lads. Many a town is ruined by the misdirected activities of its boys and many another is given a quality of stability by the helpful influence of well-trained youth.



FIRST FLOOR OF STOREHOUSE

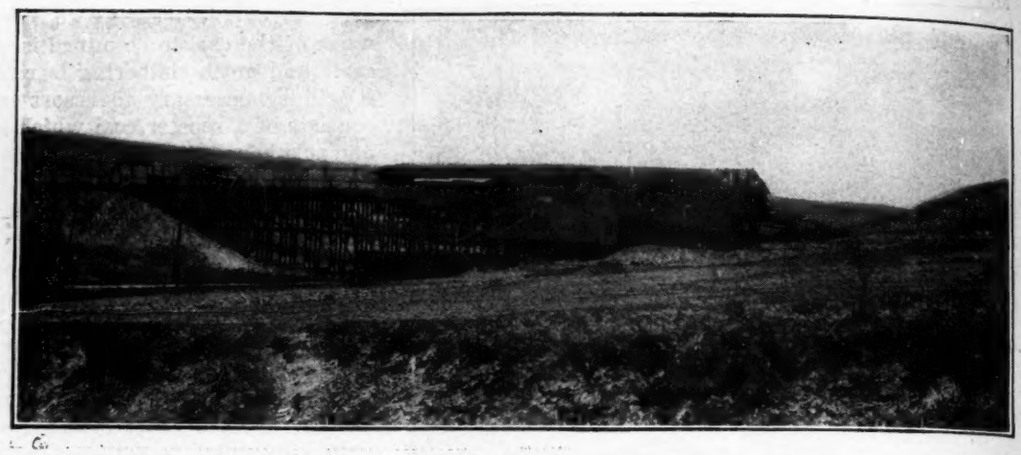
Time was when the mine foreman's shanty was the storehouse. There were only a few parts to keep, but even then they often were lost. The growth of mechanization has made storehouses necessary. This one is of brick. This, the first floor, is used for the storage of machine parts.

There are no special features of interest connected with the inside work of the mine. Steel mine ties are used in all rooms and 5x6-in. or 5½-in. wooden ties with 70-lb. rails are used on all main haulage tracks. Four 6-ton gathering locomotives and also horses and mules are used for gathering. On the main hauls three 13-ton and two 6-ton locomotives are used.

The cars used in this mine are of the same size as those used in thin coal. Cars of this size can be more conveniently handled in case they are derailed inside the mine, and even though no locomotive is immediately available for their rerailing. This quality more than offsets any losses due to decreased carrying capacity. The cars are of an all-steel pressed-body type with special patented features designed by Mr. Lubken, then general superintendent of the coal-mining operations of the Cambria Steel Co. These were illustrated in an article by the author on the Rolling Mill-Rosedale Mines at Johnstown in *Coal Age* of Sept. 7, 1922.

Tipple

This structure was built wholly from timber either sawed on the company's land or brought in from nearby mills. It was erected before the railroad was completed. The cars are discharged by rotary dumps and returned by kickbacks.



The tipple is of wood, all the timber for its construction being sawed on the company's or adjacent property. It was built before the railroad to the mine had been completed. All cars are discharged on rotary dumps, and kickbacks are used to return the cars.

From the dump the coal goes to crushers, the sizes under ¾ in. being bypassed directly to the loading-out chutes. The lump coal is crushed to sizes between ¾ in. and 3 in., all slack less than ¾ in. being screened out. None of the coal is washed. The slack is used in the coke ovens at Johnstown and the larger coal in the gas producers at the same place. In this connection it should be mentioned that the local Johnstown low-volatile coal is not a coking coal in itself, and it is necessary to mix it with gas coal to produce a coking mixture. This was one of the reasons for acquiring this property. Near the tipple is a small pumphouse containing an electric pump which lifts water from a 90-ft. well for use in the town and plant.

Method of Keeping Track of Men and Tonnage

Each miner has two checks. One is an identification check that he always keeps with him regardless of location. The other is the usual time check which is dropped in a box in the time office on the way into the mine. The timekeeper records it and then hangs it on a board where the man can get it again when he comes out. Numbers are assigned according to the mine, a special set being reserved for men working on general company work.

In an operation of this size the dispatching of coal cars is not a difficult problem. It is handled by the locomotive boss, who is responsible for the motormen being on hand and who also keeps tabs on trips. Each motorman reports on a blackboard the number of cars handled on each train. The locomotive boss knows what tonnage should come from each section and in this way allots the necessary empties. Every hour the number of tons dumped from each mine is telephoned from the tipple to the office.

Each week is held a company meeting which is attended by the various bosses, foremen and officials, and here all questions of policy, problems of operation, etc., are thrashed out. The storehouse is a two-story brick building and is a model of its kind. On the first floor all machine parts are stored, being kept in numbered bins. Each part has its own place, and the bins are grouped by machines. On the second floor bolts and miscellaneous materials are stored. Separate bins are used for bolts and all small articles.

In accordance with usual practice the cap house, which is of brick, is located at one end of the storehouse and the powder house is at the other end. These buildings carry about a day's supply, the balance being stored in separate storehouses in the valley back of a hill that bounds the town. An interesting feature of the powder house is the absence of light or heat inside. The only source of illumination is an electric light over the window through which the powder is passed out, making the storage as nearly safe as possible.

Oil pumps and sunken tanks are used in the oil house, which is provided with one 500-gal. tank for machine oil and one 1,000-gal. tank for crude oil. Both are set in concrete. This has been found to eliminate much waste. Before these reservoirs were installed, raised tanks were used, and someone was always letting the oil drip or run, no matter how much that practice was deprecated. The oil house is not heated.

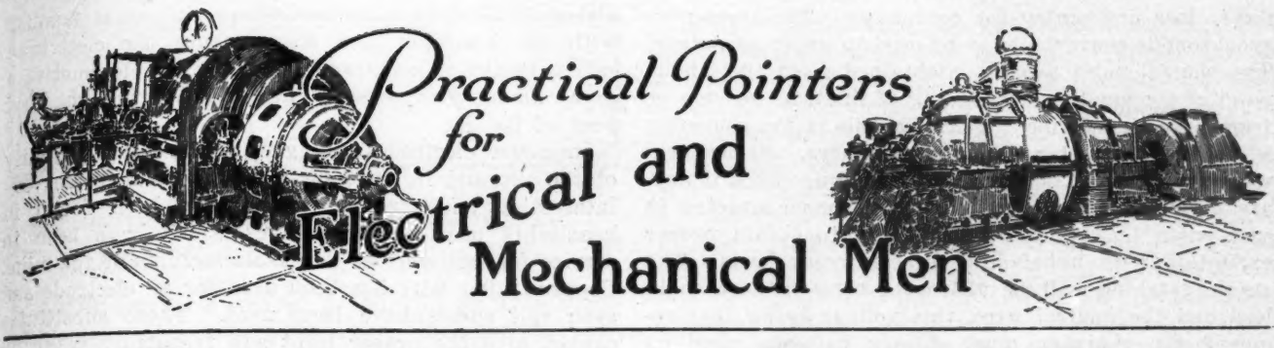
Slickville forms an interesting example of the trend of modern mine management. The property is one which is good for at least twenty years of operation based on present capacity, and plans have been made with this in view.

Jarring Blasts Save Lives from Blowouts

By F. C. Cornet

TWO methane outbursts of great violence, both killing men and doing great material damage, occurred in Belgium in March, 1923. One was at Paturages, the other at Quaregnon. They brought to a climax the controversy, between the operators on one side and the Department of Mines on the other, regarding the demand of the former that they be permitted, at the working faces, to use the jarring-blast method of initiating blowouts. Public opinion and the press took the side of the operators. So did the miners' union. The Department of Mines authorized a three-months' trial of the jarring blast in part of the Mons district.

The operators wasted no time and immediately introduced in their mines the long forbidden method. During the first week of the present month (April, 1923) a blowout of the first magnitude provoked by a jarring blast occurred in the Rieu du Cœur Mine, at Quaregnon. It killed nobody, as the men had left the mine, the shots being fired from the surface. The damage was estimated at less than $20. The operators of Belgium now feel sure that they will be permitted permanently to use the jarring-blast method of operation wherever it is advisable to do so. It long has been regarded in France as a life-saving provision.



Voltage and Load Control of Alternators

IF AT any instant the electromotive force of one generator is lower than that of other machines with which it is connected in parallel, it will take current from the other generators instead of feeding current into the line.

That the electromotive forces may be the same at all times, the generators must conform in frequency, phase and wave form, otherwise pulsating currents will be set up. If similarly designed machines are adjusted for the same voltage and operate at the same uniform speed, these conditions usually are fulfilled.

The distribution of the load on alternators operated in parallel is determined by several factors, the primary one being the speed. If the governors on the driving machines give different speeds, that which runs at the greater speed will carry a greater proportion of the load until the speed is reduced, when the second machine will begin to carry the load. Before this condition is reached one generator may be running as a motor, as the tendency is for the speed to be higher than it would be if it were not running in parallel.

The effect on the engines of a periodic transfer of load occasioned by hunting between two machines running in parallel is somewhat similar in effect to throwing the load on or off a single engine at short equal intervals which may be measured by one or several pulsations in the combined turning efforts applied to the engine shaft.

In some extreme conditions the pulsations of load may amount to more than the normal capacity of either machine. With no external load one engine may then alternately drive the other, which evidently will be a more severe condition than if the load were only applied and removed from a single engine.

Different than with direct-current generators, when the rheostats of two alternators running in parallel at normal speed are not adjusted to give proper excitation, an idle or cross current will flow between the armatures, the value of which will depend only upon the difference in field charges of the machines. This cross current may vary over a wide range, from a minimum of zero when both field charges are normal, to more than full-load current when they differ greatly. The effect of this cross current is to increase the temperature of the armatures and, consequently, to cut down the output of the generators. It is important, therefore, that the rheostats be so set as to reduce the cross current to a minimum. This cross current is registered on the ammeters of both generators and usually increases both readings. The sum of the ammeter readings will be a minimum when the idle or cross current is zero.

In general, the proper field charge of a machine running in parallel with others is that which it would have if running alone and delivering its load at the same voltage.

In order to determine the proper position of the rheostats it is necessary to make trial adjustments after the alternators are connected in parallel until that position is found which reduces the sum of the ammeter readings to a minimum for a given load.

It is therefore obvious that by a combination of changes in the two rheostats—i. e., by cutting one in and the other out at the same time—the strength of the cross current may be varied considerably while the electromotive force of the system remains constant, and the load will be divided between the two machines practically the same as before, because, as pointed out above, the division of the load is a function of the speed at which the prime mover drives the generator.

Welding Cast Iron

ONE of the most difficult welds to make is a cast iron weld. The welding process forms a layer of extremely hard metal with low mechanical strength just under the deposited metal. This prevents a proper knitting together of the cast iron and welding material, which causes failure to take place in this area. To overcome this condition several methods have been developed, some of which are fairly successful. One method is to prepare the specimen for welding and then drill and tap the area with holes into which stud bolts are screwed. The stud bolts are left projecting out of the cast iron and the weld is made to the cast iron and studs. By this method the studs serve to tie the deposited metal to the specimen.

Another method is to make the weld with a non-ferrous electrode, such as bronze of certain alloy and copper nickel alloy. These metals deposit without the hard film referred to, and if properly done the weld will show high mechanical strength. Positive polarity in the electrode should be used for non-ferrous electrode work.

Reducing Voltage in Synchronous Converter For Locomotive Battery Charging

CONSIDERABLE economy may sometimes be effected in charging storage battery locomotives by the use of a three-wire synchronous converter. When the trolley voltage is 250 and the battery charging voltage is about 125, obviously it is necessary that the trolley voltage of 250 be reduced by some means. Frequently the voltage reduction is made by inserting resistance in series with the battery or by the use of a motor-generator set.

Both these methods are relatively expensive, due to

power loss and outlay for equipment. The three-wire synchronous converter may be used to great advantage. The neutral point usually is obtained from the middle point of the low-tension winding of the transformers or from auto-transformer balancing coils if the converter is used without step-down transformers. Series field windings on main poles and commutating poles, if any, are divided into two equal circuits, one connected in each main lead. This is necessary to obtain proper excitation with unbalanced direct-current loads. The result obtained will be 125 volts between each main lead and the neutral wire, this voltage being that required for charging most storage batteries used on mine locomotives.

Polarity, Composition of Electrodes and Adjustments for Luminous Arc Headlights

THE popularity of the luminous arc headlights for mine haulage locomotives is still well established, yet there is some confusion with respect to the polarity of the electrodes. With incorrect polarity it is possible at times to get seemingly satisfactory results for a time and it is for this reason that the incorrectness of polarity is not quickly and readily realized.

Incorrect polarity will not give the proper volume of light; the arc is unstable and of a greenish color. With correct polarity the arc gives a brilliant white light and burns steadily.

The upper electrode is a copper composition and the lower electrode is a magnetite composition. When properly connected to the circuit the upper electrode is positive and the lower electrode is negative.

Every arc is characteristic of its negative electrode—that is, the negative electrode determines the quality and color of the arc. When a new lower electrode is put in the headlight, it should be burned for about five minutes before being sent out on a locomotive. This time is necessary to burn off the iron cap on top of the electrode, during which time the arc is somewhat unstable.

After the electrode has burned for some time the top becomes a molten mass, and when it cools the end becomes hard and uneven. When the headlight is put in operation again, this readily melts. The end should never be knocked off.

The electrodes of luminous arc headlights burn a very long time. The upper (positive) electrode has a life of about 2,000 hours on 4-ampere headlights and about 3,000 hours on 2-ampere headlights. Therefore it is rarely necessary to adjust it more frequently than every two or three months. The lower electrode (negative) has a life of 75 to 100 hours on 4-ampere headlights and 150 to 200 hours on 2-ampere headlights; after ten hours' burning it should be adjusted.

Many users of the luminous arc headlight have found it to be so satisfactory in operation, when connected with the proper polarity, supplied with the correct electrodes and properly adjusted that whenever any difficulty is experienced they immediately check up on these points and almost invariably find the cause of the difficulty.

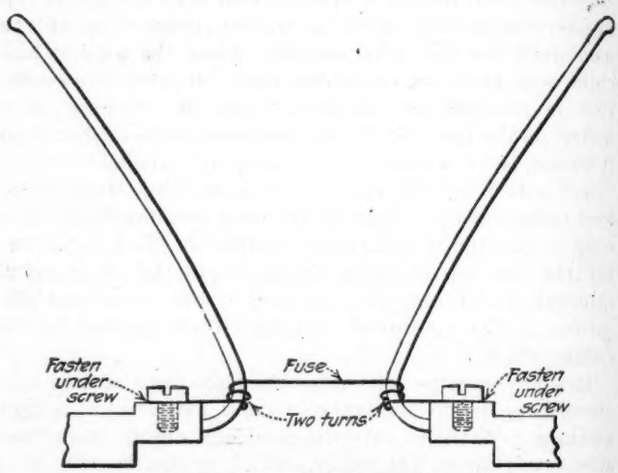
Wrong polarity occasionally is found to exist when the headlights come in on a new locomotive, and if not properly corrected on putting the locomotive in operation this condition may exist for an extended period, giving poor operation and being wasteful of electrodes. This may be due to the fact that the locomotive is placed at work in a section where no one is familiar with the headlight and also because the electrician rarely thinks it necessary to give a new locomotive a great amount of personal attention during the first year of its life.

Improper electrodes will greatly affect the stability of the arc and in checking into this detail some very interesting and strange things have been found in headlights used on locomotives which have been in service for long periods in remote sections of the mine. Copper trolley wire has been used for an electrode and even rail spikes have been used. These substitutes cannot give the proper light and frequently result in damage to the headlight and accidents on the haulage system entailing expense that would pay for obtaining and installing the proper electrodes.

The adjustments to the electrodes should be done regularly; this does not inflict any undue burden upon anyone because the inherent characteristics of the headlight automatically maintain proper adjustment for over ten hours of service.

How to Fuse a Horn Gap

IN A large number of relatively low-voltage alternating-current distribution lines the horn-gap fuse is most popular. Its advantage is that it does not require any cumbersome piece of equipment when it becomes necessary to re-fuse the line after some condition has arisen which has blown the fuse. However, a troublesome feature in connection with the horn-gap fuse is that the fuse wire is held under a screw or some form of wing nut which in the rupturing of the fuse very often becomes burned or welded fast by the arc following the fuse wire back to the screw while opening the circuit. This condition is very annoying and troublesome to the repair man who must sometimes renew the fuse in inclement weather and under inconvenient conditions on the top of a pole or on a dangerous switching tower.



ARC WILL NOT BURN THE SCREWS

Melting of the fuse carries the arc to the horns where it raises and stretches until broken and thus ruptures the circuit.

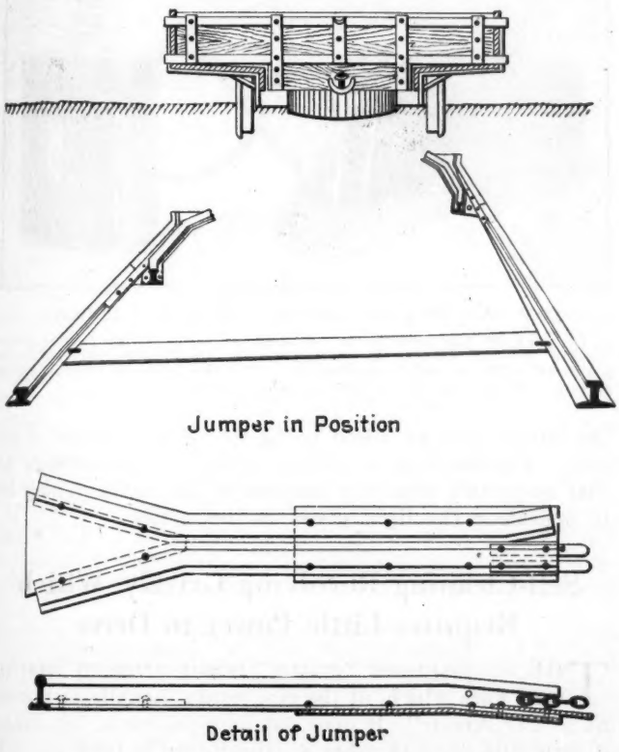
The method for fastening a fuse shown in the figure easily prevents the arc from burning the screw. It will be noticed that the fuse wire is wrapped around each horn before being attached under the screw. When the fuse is blown, the arc follows the fuse wire back to the horns and then goes up the horns, leaving the screw untouched.

New Equipment

Rerailing Device in Room Permits Car To Be Placed Near Working Face

MUCH energy is wasted at the working face whenever coal is loaded by hand. The actual work accomplished in foot pounds may be calculated by multiplying the net weight of the load by the height of its center of gravity above the bottom. Because in loading the coal must be tossed to a level higher than the side of the mine car and must be given energy of translation, much useless effort is expended. By bringing the mine car close to the face this can be remedied in part, for the distance the coal has to be thrown is thereby reduced.

A track device which may be used in a room or heading was patented recently by the Skinkle Mine Car



FROGLIKE JUMPER TO RERAIL CAR AT FACE

In England cars are quite frequently removed from the rails near the face. With the jumper shown the rerailing is easily accomplished. Steel plates would make this provision for easy loading feasible even where the bottom is soft and the car has to be run along the working face. This would avoid double shoveling, which in low coal is distressingly hard work and always destructive of coal of large size.

Jumper Co., of Huntington, W. Va. By its use an empty mine car can be pushed off the end of the track and over the bottom to a position as close to the face as will favor the loading of coal. Whether animals or locomotives are employed in gathering, little difficulty is experienced in rerailing a loaded mine car over and through the rerailers and onto the room track beyond; especially is this device practicable where mining leaves a smooth, hard floor which expedites the movement of the mine car from the face to the track.

As shown in the figure, the two jumpers are fishplated each to the end of one of the rails. These may be attached one in advance of the other wherever the ends of the rails used at the face fail to be opposite. With two wheels on one rail and two on the smooth bottom the mine car will move in line with the track and completely rerail when the rerailing device on the other rail is reached. In fact, it might be well to lay the room track at all times so that one of the two jumpers will be slightly ahead of the other, for in that case the guard rails will guide the wheels until all four are on the track. Whenever a locomotive goes into a room thus equipped to pull out a car, it must of necessity be provided with a short towline for pulling the loaded mine car onto the room track

Enclosed Room Hoist Is Safe, Sturdy, Easily Portable and Convenient

TO MEET the ever increasing demand for a completely guarded room hoist, the Flood City Mfg. Co. has developed a totally enclosed steel frame hoist which besides meeting all the requirements of the mining and compensation codes, embraces several desirable features not heretofore found in hoists of this type.

Fig. 1 shows the completed hoist, on which no moving parts are exposed. The opening for the rope is provided with rollers at either side which guide the rope on the drum and protect it from being cut or damaged by the plates should the load not be directly in front of the hoist. The brake lever and clutch lever are placed at the side within convenient reach of the operator.

Fig. 2 illustrates the left side of the hoist, showing the construction of the gears and friction. One of the very desirable features of this hoist is the cone friction clutch which consists of a wood friction block bolted to the drum and which engages in a machined surface on the inside of the rim of the main gear. Operation of the clutch is obtained by means of a steel screw working in a bronze nut. A suitable hand lever is provided for operating the screw. By operating a lever the drum shaft and drum are forced endwise, thus engaging friction. Release is obtained by a coil spring placed between the gear and drum. Bearings of both shafts are 2-in. bronze bushings, and are interchangeable. Lubrication is by means of compression grease cups accessible through holes in the frame.

For direct-current power, the motor is a standard

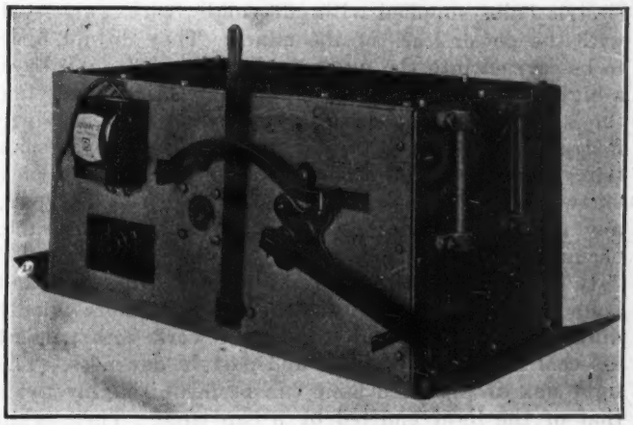


FIG. 1—BOXED-IN ROOM HOIST

The enclosing case makes the equipment safe and compact. The design of the bottom is such that the hoist may be skidded to a new location under its own power.

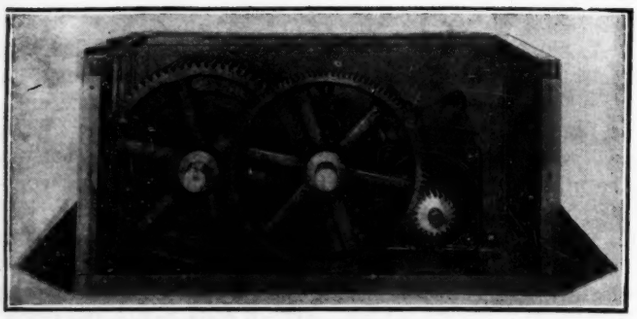


FIG. 2—REPAIRS AND INSPECTION EASILY MADE

Top and side covers, when removed, give ready access to all parts. Foreign materials cannot get between gears and pinions. Unauthorized adjustments are less frequent.

compound-wound crane-type motor of any standard make. Control is by means of an enclosed fused knife switch which connects the motor directly to line. As the motor is always started without a load this is permissible and eliminates all control and resistance troubles.

For alternating-current power a wound rotor or high-torque squirrel-cage motor with fused knife switch is used. The hoist is geared to a speed of 100 ft. per minute, and with a 5-hp. motor will develop a rope pull of 1,500 lb.

With either drive the motor is started by closing the knife switch, and after the motor has attained full speed the clutch is engaged, which can be done by manipulating the lever in such a manner that the load is started without any jerk. By allowing the clutch to slip, the load can be moved at any speed or any distance desired.

Cap Lamp Having a Solid Electrolyte

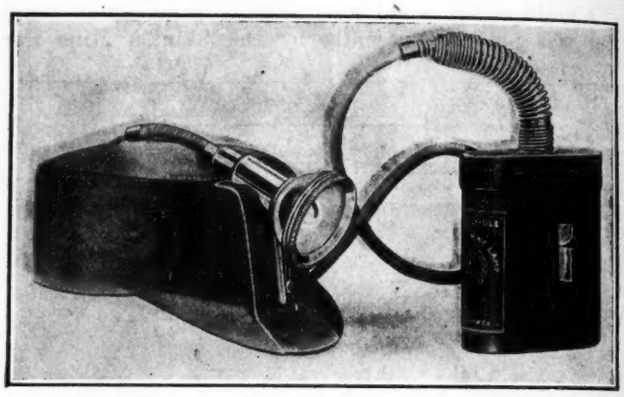
ONE of the earliest of cap lamps was the CEAG, manufactured by the Concordia Electric Co. It scored a greater success in Europe than in America because of the preference in this country for a cap lamp. The British Home Office in a competition in 1912 gave it first place out of 197 lamps submitted. Europe did not object to using a hand lamp, and indeed the preference was all in favor of a lamp that could be so carried and that could be hung to a nail.

Perhaps it is too late to argue that Europe may be right. As a rule the workman is not to be argued with. He has his notions and refuses to try out what does not please him. Yet it may be said that the United States Coal & Coke Co. is having considerable success with stationary lamps. These, however, are ordinary electric bulbs supplied with current by wires connected with the power lines of the mines. They do not have to be carried into the mines with every shift, and have a higher candle power. As for the objection to carrying the lamp, that surely is not serious wherever the miner is transported almost to his working face on a man trip. When he has to walk in and out and carry a pick or two, a drill or a keg of powder and a dinner pail, any additional load is looked upon as an unbearable encumbrance.

It might be well to give the reasons why the hand lamp is regarded as preferable. It gives a more equally diffused light. The miner does not work with part of his coal in a glare of light and part in darkness. The light flux of the hand lamp can be made roughly twice that of the light emitted by a cap lamp. Then again hand lamps have a hook which makes it possible for the miner to work unimpeded by a cord. Furthermore, the battery is not dragging from a strap. When the electrolyte is liquid it is likely to be spilled if the battery is carried on the person, and men have been burned in consequence of this fact. Another advantage is that the one vulnerable part of the outfit is omitted—the cord. This item in the equipment, though now much improved, was in early days a source of much trouble. For these many reasons perhaps the last word has yet to be spoken as to the possibilities of the hand lamp.

However, the manufacturer cannot dictate. He has to follow prejudices as to construction even though he feels they are inadvisable. So the CEAG is being made for use as a cap lamp, and, what is more, one of the difficulties, that of leakage of the electrolyte in the battery, is being eliminated by the use of a solid instead of a liquid. This safety lamp was approved by the U. S. Bureau of Mines under the new schedule No. 10-A, it being the first to receive certification under the new ruling.

As the electrolyte is a gel no burns can be received, as is the case with a liquid, whether acid or alkaline,



CAP SAFETY LAMP WITH BURNLESS BATTERY

To prevent the possibility of leakage and to keep the electrolyte always effectively covering the electrodes the lamp is provided with a solid electrolyte. The battery is locked by a strong magnet and so cannot be tampered with.

the burns from an alkali being worse than those of an acid. Furthermore it always covers the electrodes, so that no matter what the position of the battery may be in operation the light given is the same.

Self-Cleaning Revolving Grizzly Which Requires Little Power to Drive

THE old fashioned "grizzly" is a grating of iron or steel bars which, at the coal mines, usually is known as a "bar screen." It does not do good work, for many a little pile of slack rests on the top of a lump of coal and slides placidly down the screen without realizing how narrow is the chance that keeps it from an early fall.

For this reason the revolving grizzly has been introduced, the bars being circular and the mine product being run over the outside of the circle. It is like a screen, but it has bars instead of a mesh, and the run-of-mine is run over the outside instead of the inside.

This grizzly in revolving turns the lumps over and does it in a few inches of screen travel. Slack will travel almost any distance over a bar screen, for the lumps are not disposed to turn over. However, it is an unfortunate fact that the revolving grizzly will sometimes take a piece of irregular coal or other material and turn it over till a small diameter is presented to

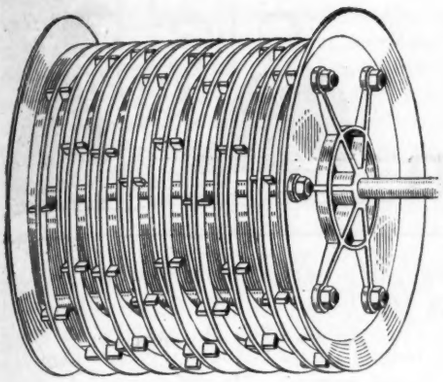


FIG. 1

PERSPECTIVE VIEW OF GRIZZLY

Note that the rings are all level at the top of the grizzly and far apart at the bottom, giving plenty of room for the escape of the material which has passed through the upper part of the rings into the grizzly. For this reason the device does not clog with screened material.

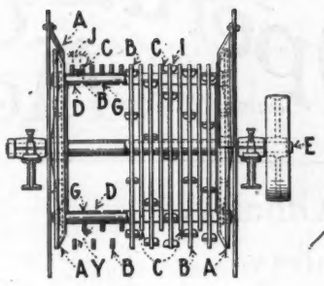


FIG. 2

CONSTRUCTION DETAILS

Here can be seen the spacers which keep the loose rings from spreading. They bear on the small rings. As these are firmly held by sleeves on the six rods they cannot get out of alignment.

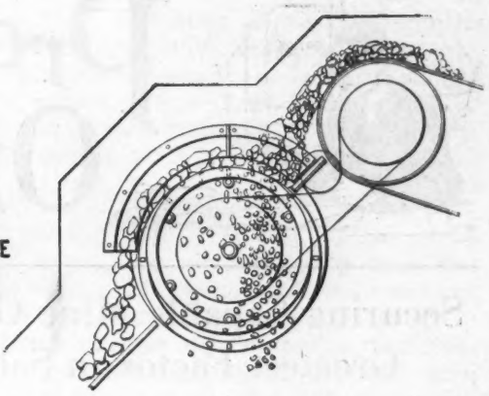


FIG. 3

SIDE ELEVATION SHOWING SCREENING

Here again can be seen the opportunity given for an escape of the screened material. The large rings are dangling all the time from what for the nonce is the uppermost rod. The opening, therefore, is largest at the lowest point in the grizzly. Such a device cannot fail to have large capacity.

the screen. That piece of coal falls into the grizzly but does not readily fall out until it has been lifted or rolled about. Several of these pieces are likely to load up the grizzly and oppose the passage between the bars even of pieces which are of the right diameter in all directions. This clogging of the grizzly increases the driving power needed and makes it necessary to shut down the machine till the obstruction has been cleared.

A new type of this device, shown in Fig. 1, which corrects the faults of the ordinary revolving grizzly, has been devised, its initial purpose being to screen copper ore. It was invented by Kenyon Burch, for the Copper Queen Concentrator, near Bisbee, Ariz.

Fig. 2 shows the details of construction. Two disks, or heads, *A*, are connected by a shaft, *E*, and six rods, *G*, are set in a circle somewhat near the periphery. The ends of the shaft extend through the heads for support on bearings and take the driving pulley, as shown. The screen rings rest on the rods. Some are of one and some of another diameter. The smaller rings, *C*, are held firmly in position by sleeve-like spacers, *D*, which surround the various rods, *G*, as can be seen best in Fig. 4. The larger rings, *B*, are kept in place by occasional spacers, *I*, but they swing free, and, consequently, though the rings are all at the same level at the top of the grizzly, that is anything but true at the bottom, the large rings standing well below the others at that point. In Fig. 2, *Y* and *C* represent the small rings which revolve with the grizzly and *B* represents large rings that do not so revolve. It can be seen, therefore, that any coal or other material trapped at the top of the grizzly is readily able to free itself at the bottom. For this reason the device is non-clogging.

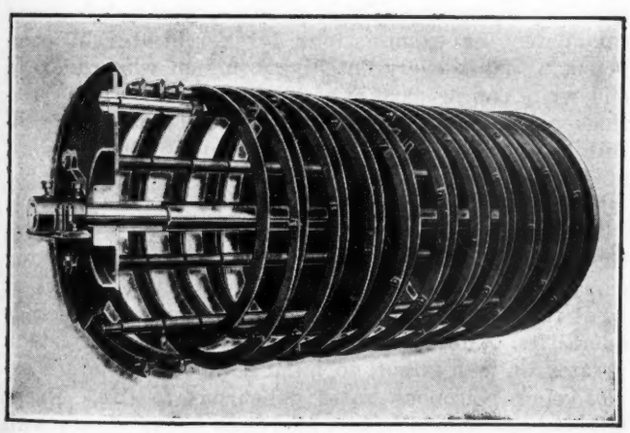


FIG. 4—BURCH GRIZZLY WITH RINGS PARTLY REMOVED

An excellent idea of the sleeves on the six rods can be obtained from this view. They hold the small rings firmly in place so that they cannot move sidewise from the position in which they have been placed.

Sales of Explosives Decline in February

Explosives manufactured in the United States and sold during February, 1923, according to reports to the U. S. Bureau of Mines, amounted to 588,556 kegs of black blasting powder, 4,460,178 lb. of permissible explosives, and 16,559,865 lb. of high explosives other than permissibles. These figures, based upon reports from companies that manufacture about 90 per cent of all explosives used in the United States, show increased sales of high explosives as compared with January, 1923, but reductions in sales of black powder and permissibles.

Sales of black powder during February were 28 per cent below the amount sold in January, 1923, 10 per cent more than February last year, 52 per cent more than February, 1921, and 28 per cent below February, 1920. During the first two months of the present year, 1,405,249 kegs of black powder have been sold, an increase of 34 per cent and 61 per cent, respectively, over the first two months of one and two years ago, but 18 per cent below the amount sold in January and February 1920. Of the total quantity of black powder sold in the first two months of 1923, 90.4 per cent was for coal mining.

Sales of permissible explosives in February showed a decrease of 17 per cent from the record for January, but an increase of 34 per cent over February last year, 74 per cent over February, 1921, and 14 per cent over February, 1920. The combined sales for January and February, 1923, have amounted to 9,836,548 lb., an increase of 60 per cent, 51 per cent and 18 per cent, respectively, over the two-month periods of 1922, 1921 and 1920. Of the permissibles sold in the first two months of 1923, 94.9 was used in coal mining.

February sales of high explosives other than permissibles were substantially the same as in January, an increase of less than 0.1 per cent being noted. As compared with February in previous years, however, the February, 1923, sales were 43 per cent more than February last year, 42 per cent more than February, 1921, but 9 per cent less than February, 1920. Of the high explosives sold in January and February, 1923, 18.6 per cent was for coal mining.

Problems of Operating Men

Edited by James T. Beard

Securing Capable Mine Officials Greatest Factor in Safety

Safety Circular of C. F. & I. Co., Approved by Bureau of Mines—Certifying Mine Superintendents —Efforts of Bureau of Mines to Educate Miners

ACCORDING to the letters of Robert A. Marshall, *Coal Age*, Nov. 16, p. 799, and W. H. Perdue, Jan. 11, p. 59, a circular was recently issued by the C. F. & I. Co., calling attention to certain things and making recommendations in the interest of safety. The circular was issued with the approval of the Bureau of Mines.

Among the recommendations contained in the circular was one urging "that all persons in responsible charge of the direct operation of coal mines, including superintendents, foreman, mine bosses and shotfirers, should be required to have certificates of competency issued by the state and showing that the applicant has passed an examination clearly establishing his knowledge of what constitutes up-to-date safe practices in the branch or branches of mine operations under his jurisdiction."

In discussing this question, Mr. Marshall remarked, "If the certifying of superintendents will make our mines safer I am for it heart and soul." Personally, it is hard for me to understand how the certifying of superintendents of mines would have any detrimental effect that would invite any opposition to such a measure. In Colorado,, the mine foreman is required to report to the superintendent for instructions and advice. For that reason, it is important that the latter official should have a thorough knowledge of underground conditions and requirements.

Without that knowledge, let me ask, how can a superintendent safely direct a foreman in matters pertaining to the work in the mine? It is true, I admit, that the Colorado law gives the mine foreman "full charge of all the inside workings and of all persons employed therein" (Sec. 44); and further states that "any superintendent or other person who interferes with the mine foreman, in the discharge of his duties as described by this Act, shall be deemed guilty of a misdemeanor."

Occult Influence of the Mine Superintendent

Nothwithstanding this provision of the law prohibiting the superintendent from interfering with the mine foreman in respect to the duties of the latter, there can be no doubt of the controlling influence the superintendent exerts by virtue of his superior position. Any foreman well knows that his superintendent has the power to discharge him whenever he may desire, besides being responsible to the management for the showing on the cost-sheet.

In many instances, the foreman realizes that it would be difficult, if not quite impossible, to explain to a superintendent having but a partial knowledge of matters underground, the need for certain work that to his mind is imperative. For this reason, a foreman is liable to allow certain things to go without giving them the attention they should receive. He determines to wait, until conditions appear a little more favorable, preferring to take the chance of increased danger rather than risk his good standing with the superintendent.

Speaking of examinations for certificates, my opinion is that not only should every mine superintendent be certified but he should hold a higher grade of certificate than that required of the foreman. His examination should prove that he has a superior technical education and a longer experience in mines than what is necessary for mine foremen. Having charge of the outside foremen also, the superintendent should prove his knowledge of surface requirements, including all types of machinery and equipment.

While I do not look with favor on the idea of repeated examinations and the limiting of certificates to a period of five years, as has been suggested, I do think that all certificates should be revokable for cause. It seems to me an unnecessary requirement to expect a well posted practical mine official to submit to repeated examinations, at stated periods or intervals.

Mining Men Should Be Students of Mining

In order to secure competent mine officials, which is the greatest factor in the safe operation of a mine, it is my belief that the work must begin with the education of mining men. My idea is that men seeking a position of responsibility in coal mining should become students of mining and should take a course extending over a period of years, a goodly proportion of which should be devoted to practical work underground that would make them familiar with every requirement.

In this regard, I do not refer to the accustomed cramming for examinations that is so common today among candidates for examinations for certificates of competency. Most every intelligent miner who can read and write can prepare himself for answering the questions asked in mine examinations, by studying faithfully for a period of six or eight months. The standard of examinations should be higher, that this sort of cramming could not insure the success of the candidate.

To be frank in the matter, I do not believe in second-class certificates, which make a man eligible for taking charge of a mine not generating gas. Who knows at what time such a mine will generate gas in dangerous quantities. Moreover, most mines are subject, to a greater or less extent, to mine fires that generate explosive or poisonous gases dangerous to life. Every mine official should have a thorough acquaintance with the properties and behavior of these gases.

The Bureau of Mines has shown a deep interest in the education of miners. To that end, they have published numerous pamphlets and bulletins, giving the

miner careful instructions in the use of safety lamps and other appliances employed in the practice of coal mining. Others of these bulletins describe the properties and behavior of mine gases, methods of timbering and many subjects of practical benefit to the miner.

Were it not for the lack of needed appropriations, I feel sure that the Bureau of Mines would adopt some scheme that would bring them in closer touch with students of mining, through the establishment of mining courses, as has already been suggested by Mr. Perdue, in his letter to which I have referred, previously. In that connection, the mine-rescue stations, established by many of the larger coal companies, in different districts, would form good bases from which such educational work could be directed.

As is well known, the prime object of rescue stations is the promotion of safety and what work would be more befitting their purpose than the education of mining men on a broad practical basis? THOMAS ALLEN.

Mount Harris, Colo.

Violation of Mining Laws Chief Cause of Explosions in Mines

Something lacking in the administration of affairs in mining—Not inadequate laws—Personal element responsible for occurrence of mining disasters.

ATTENTION has again been drawn to the frequency of mine disasters during recent months, by C. W. Atkins, writing in *Coal Age*, Feb. 15, p. 302. Mr. Atkins is quite right when he says there is something lacking in our administration of affairs in the operation of mines. However, to my mind, that *something* is not the want of adequate mining laws, as many imagine. Instead, I believe, the cause must be sought in the personal element that is always present and hard to eliminate.

A study of the situation will show that those countries and states that have the best possible mining laws are not exempt from these occurrences. Our mining laws have been drafted to cover most of the dangerous practices in our mines and, with few exceptions, these laws are adequate.

MINING LAWS, RULES AND REGULATIONS DISREGARDED

In my opinion, the frequent recurrence of mine explosions is not the result of inadequate legislation. The trouble is that the laws we have are not strictly enforced; and we all realize that a law is of no value, unless it is enforced and every individual worker made to obey the law. A chain is no stronger than its weakest link and every man in the mine is a link in the chain of safety.

As I said before, the personal element is the chief factor in preventing the frequent recurrence of mine disasters. On previous occasions, investigation has shown that incompetence, ignorance, carelessness or disobedience to orders has been the direct cause of the disaster. In the majority of cases, the act has been an open violation of the mining laws or mine rules and regulations.

To one who has had years of experience and traveled much, it is a revelation to observe the manner in which both the laws of the state and the rules and regulations of the mines are disregarded, by mine workers and often winked at by the mine officials. In a few instances we find mines where discipline prevails and violations are suitably punished by the management.

On the other hand, how often do we find that the men holding responsible positions and on whom the lives of hundreds of workers depend, are incompetent. It is this class of worker or type of official that we have most to fear and should strive to eliminate in the operation of our mines.

HOW MINE DISASTERS MAY BE AVOIDED

Finally, let me add that it is only by the strict enforcement of our mining laws and safety rules and regulations and the careful selection and employment of experienced and competent officials, together with the training of all mine workers and impressing them with a sense of their personal responsibility for their own safety and that of their fellows, that we can hope to avoid disaster.

My answer to the question, "Should firebosses and safety inspectors be employed by the company or by the state or federal government?" is: They should be employed by the company. Employment by the state would not eliminate the personal element and would introduce a new danger, in the opportunity afforded for graft. Much as we regret to say it, there are always some men who can be bought and are willing to take chances for a slight consideration.

So long as we have men employed in the operation of our mines who can be bought, men who are willing and ready to risk their own lives and the lives and safety of their fellow workers and who openly and flagrantly violate the mining laws of the state, in order that they may make a record run and establish a reputation for themselves in the production of cheap coal; so long must we expect disasters to occur.

We all freely admit that, as individual workers, we make many mistakes that endanger ourselves and others working with us; but such mistakes are not made willingly. The all important question, in the attainment of mine safety, is how to avoid such errors and reduce accidents to a minimum. It cannot be done by assuming known risks.

The article entitled "Personal Touch in Management," in the same issue of *Coal Age*, appeals to me as conducive to a reduction of mine accidents. I believe that where officials and employees are brought into closer touch with each other and recognize their mutual relations in the safe operation of the mine, much can be accomplished in the establishment of strict discipline and greater safety will result. GEORGE HALLIDAY.

Carbonado, Wash.

The Company Store, Past and Present

Running the company store on its own merits—Biggest wage earners not always best store customers—Greasing the foreman not a reputable practice.

AT THE time of reading the interesting letter of George Edwards, *Coal Age*, Feb. 15, p. 303, I felt that much could be said in dispute of the idea that the improved status of the company store is to be attributed to the practice of soliciting the mine foreman's aid in securing customers among the miners.

Instead, I would ascribe the observed improvement in the conduct of company stores, among the larger coal companies and most of the smaller concerns, to the present tendency of running these stores on their own merits. My observation is that the average store manager, today, follows the practice of other storekeepers and tries to attract customers by offering fair goods,

at fair prices, and through the courteous treatment of his customers.

In the past, the goods offered in company stores have been of fair quality, but the prices have not been attractive in most instances. Moreover, the treatment accorded would-be customers, by the average store clerk, has been of the "take-it-or-leave-it" type and there has been little display of courtesy on the part of the salesman.

Improved Methods Bring Results

Today, things are quite different in the management of the company store. The manager himself works harder than was the custom in former days and he gets results that were never obtained under the old system. Discourtesy on the part of a salesman, or any lack of attention to the needs of a customer, is met with a sharp rebuke. The fact is realized that the store is in competition with other stores and can command trade only by the proper treatment of its customers.

In his letter, Mr. Edwards seems to convey the idea that the improvement observed in the company store of today may be attributed largely to enlisting the mine foreman's interest. It is suggested that an inspection of the payroll shows that many large wage earners are not the best customers of the store, while many who make less money consume practically their entire earnings in store orders before payday.

A little reflection should make known the fact that workmen who draw the biggest pay are those who are willing to accept the hardest tasks performed in the mine. No job is too hard for them and they are always ready to do any work they are asked. They are not seeking, like many others who make less money, the best places and the easiest work.

Under the old system of store management, the payroll was too often made the basis of judging what a man should spend at the company store. Many a mine foreman was led to believe that he would lose his job, unless he made it a part of his business to steer his men in the direction of the store, and the practice has generally proved a financial loss to the company.

The suggestion made in the letter to which I have referred, that good is accomplished by greasing the mine foreman, is bad. Such a practice is not reputable and no foreman could lend himself to it without losing his self-respect and the esteem of his men.

In closing, let me say that where such a practice is in vogue it will result in demoralizing the organization; it would be discriminating in favor of shirkers, to the detriment of good workers. In the end, the foreman would lose his job when the company discovered the financial loss that must inevitably follow the practice. I speak from a personal knowledge of such instances and know many other mining men whose experiences have led to the same conclusion.

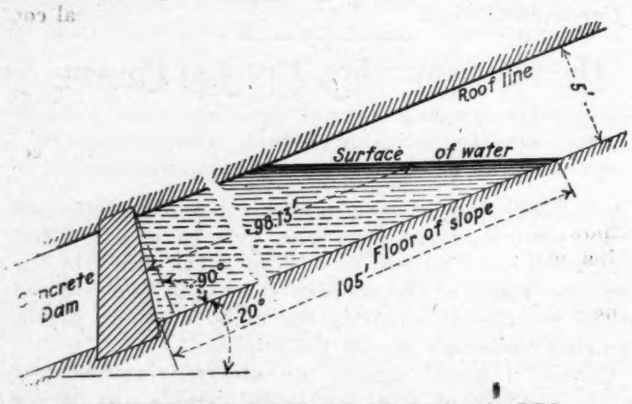
New York City. F. C. Cornet.

Inquiries Of General Interest

Concrete Dam Built on Mine Slope

Dam Built in Old Abandoned Slope—Pitching 20 Deg. — Slope Fills with Water — Total Pressure on Dam—Quantity of Water in Slope

KINDLY permit me to present a proposition regarding a concrete dam built in a slope that was long since abandoned. Originally, the slope had a sectional area of 84 sq.ft., being 12 ft. wide and 7 ft. high.



CONCRETE DAM ON SLOPE PITCHING 20 DEG.

For twenty years, a small stream of water has been running down the slope and required to be pumped out of the mine where it accumulated. In order to avoid this expense and to keep the water from running into the lower levels, a dam was built at a chosen point in the slope. In 45 hr. after the dam had been completed and sealed to make it watertight, the slope had filled with water to a distance of 105 ft. up the incline, which had a pitch of 20 deg.

Fearing that the pressure of water would break the dam, we started the pumps to avoid that danger. I should state, here, that, previous to the building of the dam, a squeeze had reduced the size of the slope opening so that it was now only 10 ft. wide and 5 ft. high, giving 60 sq.ft. for the water pressure to act on the dam. We are anxious to learn what quantity of water is in the slope when it has risen to the height mentioned, namely, 105 ft. measured on the floor. Also, what is the total pressure exerted, by the water, on the face of the dam?

Nanticoke, Pa. Albert Turley.

Assuming that the reduced dimensions give the average size of the slope that is now filled with water from the dam to a distance of 105 ft., measured on the floor of the slope and, further, assuming that the face of the dam is in a practically normal position in the seam, as shown in the accompanying figure, the surface of the water will meet the roof, at a distance from the dam, $105 - (5 \div \tan 20 \text{ deg.}) = 105 - (5 \div 0.364) = 105 - 13.74 = 91.26$ feet.

The average length of this prism of water filling the slope is, therefore, $\frac{1}{2}(105 + 91.26) = 98.13$ ft. But, the sectional area of the opening being 50 sq.ft., the volume of water standing in the slope is $50 \times 98.13 = 4{,}906.5$ cu.ft.; or $4{,}906.5 \times 7.48 = 36{,}700$ gal.

The vertical head of water exerted on the center of the face of dam is, $98.13 \times \sin 20 \text{ deg.} = 98.13 \times 0.342 = 33.56$ ft. This head corresponds to a pressure of $33.56 \times 62.5 = 2{,}098$ lb. per sq.ft. Finally, the face of the dam presenting an area of 50 sq.ft., the total pressure is $(50 \times 2{,}098) \div 2{,}000 = 52.45$ tons.

Examination Questions Answered

Miscellaneous Questions

(Answered by Request)

QUESTION—*What effect does a change in the atmospheric conditions at the surface have upon a mine generating explosive gases.*

ANSWER—A sudden fall of barometric pressure is always followed by an outflow of the gas-charged air filling the old abandoned works in the mine. The result is an increase in the gaseous condition of the mine air in the live workings.

QUESTION—*In case of an explosion in a mine whereby the doors and air stoppings are destroyed, what method would you adopt to restore circulation?*

ANSWER—The only possible way of restoring the circulation of air throughout the mine, under these conditions, is to rebuild the doors and stoppings destroyed or make temporary use of canvas as curtains to deflect the air and prevent its being short-circuited at such points. It is assumed that the ventilating fan is still running and capable of supplying the required air. The work of restoring circulation in a mine torn by an explosion is necessarily of a temporary nature when there are men to be rescued, especially if there is no properly equipped rescue corps who can safely penetrate the gas filled roads and workings.

QUESTION—*Are mine fires more likely to occur in one mine than in another and, if so, why?*

ANSWER—Yes, mines where the coal is friable and particularly inflammable, or where the coal contains much sulphur, are more subject to fire from spontaneous combustion occurring in the waste, if necessary precautions are not taken to prevent fine coal being stored in the gob. The presence of gas, also, renders some mines more liable to fires than where there is little or no gas in the seam.

QUESTION—*A shaft 300 ft. deep has an entry turned off at the bottom, 7 ft. high and 10 ft. wide. The shaft is full of water and overflowing. What is the pressure per square inch and the total pressure, in short tons, on the face of the entry?*

ANSWER—Assuming a vertical shaft, the pressure at its foot is $300 \times 0.434 = 130.2$ lb. per sq.in.

Then, if the entry is level the center of pressure at the face of the entry is $300 - \frac{1}{2} \times 7 = 296.5$ ft. vertically below the top of the shaft. This makes the average pressure on the entire face of the entry 296.5 $\times$ 0.434 = say 128.7 lb. per sq.in.; and, the sectional area of the entry being $7 \times 10 = 70$ sq.ft., the total pressure on the face of the entry is $(70 \times 128.7 \times 144) \div 2{,}000 = 648.648$ short tons.

QUESTION—*A cross-compound engine has cylinders 16 in. and 24 in. in diameter, respectively; find the piston areas.*

ANSWER—The sectional area of the smaller high-pressure cylinder. 16 in. in diameter, is $0.7854 \times 16^2 = 201$ sq.in.

The sectional area of the larger low-pressure cylinder, 24 in. in diameter, is $0.7854 \times 24^2 = 452.4$ sq.in.

QUESTION—*If the high-pressure cylinder, in this engine, has an initial pressure of 120 lb. per sq.in. find the size of piston rod when the allowable working stress in the rod is 3,500 lb. per sq.in.*

ANSWER—The total pressure on the piston in the high-pressure cylinder of this engine is $120 \times 201 = 24{,}120$ lb. For an allowable stress of 3,500 lb. per sq.in., the sectional area of the piston rod is $24{,}120 \div 3{,}500 = 6.89$ sq.in. The required diameter of the rod is, therefore,

$$d = \sqrt{6.89/0.7854} = \text{say } 3 \text{ in.}$$

QUESTION—*In the low-pressure cylinder of this same engine, the initial pressure is 20 lb. per sq.in., find the number of ⅞-in. studs required to hold the cylinder cover in place. The diameter of the ⅞-in. studs, at the bottom of the thread, is 0.73 in. and the working stress on the material is 4,000 lb. per sq.in.*

ANSWER—The area of the low-pressure cylinder, as previously found, being 452.4 sq.in., the total pressure on the end of the cylinder is $20 \times 452.4 = 9{,}048$ lb. The sectional area of a single stud, for a diameter 0.73 in. at the bottom of the thread, is $0.7854 \times 0.73^2 = 0.4185$ sq.in. For an allowable stress of 4,000 lb. per sq.in., the safe working strength of a single stud is, $4{,}000 \times 0.4185 = 1{,}674$ lb. The number of studs required to hold the cylinder head is, therefore, $9{,}048 \div 1{,}674 = 5.4$, say 6 studs.

QUESTION—*How many hour's supply would a cylindrical tank 16 ft. in diameter, by 12 ft. in depth, hold for a 500-hp. plant, which uses 34½ lb. of water, per horsepower, per hour? Assume the average load is 75 per cent of the rated capacity of the plant equipment.*

ANSWER—In this case, the average load requires $0.75 \times 500 = 375$ hp.; and the water consumption will be $375 \times 34.5 = 12{,}937.5$ lb., per hour. The cubical contents of a tank 16 ft. in diameter and 12 ft. deep, is $12(0.7854 \times 16^2) = 2{,}412$ cu.ft. The weight of water in this tank when full is then $2{,}412 \times 62.5 = 150{,}750$ lb. Then, assuming a water consumption of 12,937.5 lb., per hour, this tank will be emptied in $150{,}750 \div 12{,}937.5 = 11.65$ hr., or say 11 hr. 39 min.

QUESTION—*If coal occupies 40 cu.ft. per ton, what size of storage bin will be required to carry a three-weeks' supply of coal for a plant where the water consumption is 12,937.5 lb., per hr.? Assume a pound of coal evaporates 5 lb. of water; and state what weight of coal will be required in storage.*

ANSWER—A water consumption of 12,937.5 lb., per hr. will require an assumed coal consumption, in this case, $12{,}937.5 \div 5 = 2{,}587.5$ lb., per hr. The coal consumed in an 8-hr. shift will then be $(8 \times 2{,}587.5) \div 2{,}000 = 10.35$ tons. Now, making due allowance for maintaining fires during idle hours, Sundays and night-shifts, the average consumption of coal may be assumed as, say 12 tons, per working day. A three-weeks' coal supply, on this basis, will be $3 \times 6 \times 12 = 216$ tons, which is the required capacity of the storage bins. Allowing 40 cu.ft. per ton, the cubic capacity of the bins will be $40 \times 216 = 8{,}640$ cu.ft. Assuming a length of 100 ft. for the bins, and a width of 10 ft., the average depth of coal in the bins will be 8.64 ft.

QUESTION—*How many cubic feet of air should be mixed with one cubic foot of firedamp to render it harmless?*

ANSWER—Assuming the firedamp mixture at its most explosive point and no dust present, 1 cu.ft. of the mixture contains 0.0946 cu.ft. of methane. Then, allowing two per cent of gas is harmless, under ordinary conditions, the total volume of gas and air is $0.0946 \div 0.02 = 4.73$ cu.ft., and the volume of air to be added is, therefore, $4.73 - 1 = 3.73$ cu.ft.

Export Coal Trade Still Shows Promise Despite Decline in Inquiries

Foreign inquiries and offers for our coal have decreased somewhat in the past month, according to Federal Fuel Distributor F. R. Wadleigh. The decrease is attributed partly to the expectations of an early settlement of the Ruhr situation, partly to the increase in prices of our coal at tidewater, together with the rise in ocean freight rates. Unwillingness on the part of our exporters to give the credit asked for by foreign buyers undoubtedly has prevented a number of sales.

Additional charters are being closed and the prevalent feeling seems to be that with a decline in ocean freight rates in the last week of April and a decrease in prices of coal from the high level of March, our coal exporters will be able to obtain considerable foreign business for the next few months. In fact, some of the contracts already closed cover deliveries over from four to six months and even longer.

Overseas exports of bituminous coal (including the West Indies) for January were 79,874 gross tons, decreasing to 75,204 tons in February and reaching 270,711 tons in March. Coke exports in the same months were 11,399 tons, 12,026 tons and 35,309 tons. The bulk of the coke has gone to France, while Italy, Germany and the Netherlands have taken the greater part of the coal.

From Feb. 20 to March 12, 52 steamships had been closed for the transatlantic coal and coke trade. From the latter date to April 30 the local number of charters announced as closed was 101 for coal and 80 for coke. There are always some charters not made public, so that the number given is slightly less than the total number chartered.

Inquiries for coke are not so numerous or urgent and there is a considerable accumulation waiting to be loaded into ships at tidewater; embargoes on coke for export are in effect at both Baltimore and Philadelphia and the permit system is being used by the railroads in moving it.

Commenting on the Ruhr situation Mr. Wadleigh in his statement of May 10 says:

"While it is impossible to obtain any actual figures of the Ruhr production for the past four months, indications point to a shortage of about twenty million tons during that period, as compared with the last four months of 1922. This shortage has, of course, affected all of the western European countries, but especially those where coals for making coke are imported—viz., France, Belgium, Italy, Netherlands—increasing the demand for British coking and gas coals, and causing a rise in f.o.b. prices of the latter from 25s. to 37s. 6d. for the best Durham gas and coking coals.

"The shortage in shipments of German coke to France, which totaled 4,303,324 metric tons in 1922, has also increased the general demand for coke. In January, 1923, there were 407,663 tons of coke imported by France; in February this had fallen to 164,577 tons, of which only 84,605 came from Germany. Coke production in the Ruhr field is reported as about 40 per cent of normal; coal production about 30 per cent."

A number of American coal exporters gave their views to Mr. Wadleigh, who quotes from them as follows:

"A number of inquiries are being received from South America," one exporter said, "and I am of the opinion that the South American trade will be good during the present year, as I believe England will take a large portion of the European business on account of the short haul and will be content to let the South America business go, expecting to regain it at a later date when needed. On account of the present European situation, I do not think there is any doubt but what the export business in coal will be good during the entire year, although I do not believe it will be sufficient to cause any actual shortage in this country, particularly if there is any marked improvement in the railroad transportation in this country, which there will probably be. The demand from Europe, however, has advanced the Cardiff and other British prices to such an extent that we are beginning to get inquiries and business from South America."

"My opinion is that the present situation, if cared for properly by the American exporter and handled with even ordinary intelligence," another shipper stated, "will enable us all to develop and maintain a sane and safe business in the future. The miserable interloper who injected himself in 1920, however, must be kept out or he will do again what he did then—practically destroy the confidence of the foreign buyer in the American coal exporter."

Stability Attained by Operators Upset by Snowbirds and Adverse Strike Settlement

The Bituminous Operators' Special Committee issued a statement on stabilization of the industry May 15, as follows:

"Before the war many large companies, and in some cases entire bituminous coal-mining fields, had accomplished a substantial degree of stability in the industry. There never was a real shortage of bituminous coal from the beginning of the century.

"With the war, and the unprecedented demand for fuel, prices went so high that the 'snowbird' mines were able to open and produce coal. The effect of this is always bad, as these mines demand from the railroads, cars which ordinarily would be used to handle the output of those mines which operate all the time, whether the market is high or low.

"The effect of this dilution of railroad cars is to limit output through the transportation factor. It is easily seen that a locomotive can operate far more efficiently leaving a train of cars at a mine, than running up and down the line leaving a car or two here, another car there, for many miles, then collecting them again. The fact that the railroads are forced to deliver cars to the 'snowbird' mines cuts down supply to regular mines, limiting their output.

"A further interference with the stability of the coal industry is the fact that the strike of last year, lasting five months and causing suffering and death, was settled adversely to the interests of the public. This settlement forced the inflated war wage scale for common labor in the mines to continue. This high wage naturally attracts many unneeded men from other industries, as no skill or training is required for the work for which union miners have insisted upon being paid $7.50 a day. This overmanning of the industry has now reached the point where there are 200,000 extra men being supported by the public in the coal-mining industry, as is recognized by the U. S. Coal Commission.

"While the strike was on, President Harding recognized that the nation was in the grip of this labor monopoly. He gave voice to this thought before Congress in an address, declaring that the country was 'at the mercy' of the United Mine Workers.

"With the present tremendously expanded supply of mine labor, naturally the miners work only part time in order to make a living. They are enabled to do this because of the high wages they receive. At the same time, it would be unsound economically to fix mine wages on the supposition that the miners are going to work on part time. Putting wages at the proper level would, through the operation of economic laws, rid the industry of this surplus of 200,000 men, and help materially to stabilize the industry. The present tendency of the miners is to work only part time, regardless of the working time of the mines in which they are employed.

"The United Mine Workers of America naturally is not averse to keeping unneeded men in its ranks. Through the 'check-off' system it collects dues from its members which now aggregate $15,000,000 a year. Cutting down the number of miners to those needed to produce the nation's coal supply would lop off the unneeded members of the United Mine Workers, and consequently cut down its enormous income from membership dues.

"In the last analysis, the leaders of the United Mine Workers control 60 per cent of the output of coal. Agreements with this organization have proved of little value, as they have been broken at will on many occasions, the list of which is a long and disgraceful one."

Price of Coal to Industry Governed by Shortages Caused by Labor Unrest, Says Bradley

The Natural Resources Group of the U. S. Chamber of Commerce gave over Wednesday afternoon to the coal industry at its 11th annual meeting in New York last week. The Green Room of the Waldorf was crowded, more by those wanting to learn about the coal situation than by coal men. J. D. A. Morrow was scheduled to speak but was unable to attend. J. G. Bradley opened the speaking program after the luncheon. His address, "Labor and Its Effect on the Cost of Industrial Coal," in abstract follows. An abstract of the talk of George Cushing, the second and last speaker, was carried in *Coal Age* last week.

"Throughout this discussion it should be understood that it is my opinion that the price of coal to the consuming industries has been governed rather through the creation of shortages with attendant speculation, the shortages being brought about by interference with the distribution of coal over which the operators had no control rather than through inherent defects in the industry itself," said Mr. Bradley. "Absentee labor control on the part of ambitious union leaders of both the miners and railroad operatives has been the chief contributing influence in the creation of these shortages, as an examination of the records of the U. S. Geological Survey and the American Railway Association will show.

"In considering labor and its effect on the cost of industrial coal, the whole general question of coal-field labor comes into review, both what it is paid directly and what it receives indirectly, as well as its peculiar efficiencies and inefficiencies, its privileges and immunities, all of which have various bearings upon the cost of the coal before it can be shipped to market. It should be understood that most coal-mine labor is housed in communities constructed and maintained by the operating company. It is the custom in the coal fields to lease the company houses at the monthly rental of about $2 a room and it may be generally stated that the operatives pay about $15 per month for rent, light, heat, fuel, doctor service for the entire family and insurance for themselves, which reduces their cost of living far below that of any other class of wage earners of which we have record.

"While the eight-hour day is the standard throughout the coal fields, as a rule only the day men work for the full eight hours and those constitute but 40 per cent of the employees at the ordinary bituminous-coal operation; the miners themselves, being paid by the ton, are free to quit work as soon as they have mined the number of tons which will bring their earnings up to an amount which is satisfactory to them. It is, therefore, an occupation with special privileges.

"As an occupation coal mining has its compensations and it is rarely that a man engaged in it leaves it for other pursuits. The operators have been charged with maintaining in the industry more men than are necessary to carry it on, but this is something which they could not do by force and if there is an oversupply of mine labor it is because of the attractions offered to the workers by the industry itself, and in the union districts to the encouragement held out by the labor leaders for the realization of a full-time wage for part-time work.

"According to the preliminary report of the U. S. Coal Commission there were employed in the bituminous-coal industry 663,000 men, or more than 60 per cent of all the employees engaged in all kinds of mining in the United States, and of these 663,000 men, about 500,000 are claimed as members by the United Mine Workers of America. The total number of wage earners of the country as shown by the last available census figures is about 9,000,000. It therefore appears that about 7 per cent of the wage earners of the country are engaged in the production of bituminous coal. The production per man in 1921 was, as shown by the U. S. Coal Commission's figures, about 650 tons each.

"Only for short periods since 1918 has the price of coal to industry been closely related to the cost of production. It has been controlled by its availability in the market, which has depended upon and been influenced by various interruptions to the process of distribution brought about by strikes both within the coal industry itself and on the railroads. In other words, it has been the interferences with the orderly conduct of the business which has made the market price, rather than the cost of production itself.

"There has been a growing tendency in both union and non-union mines toward absenteeism on the part of the well-paid workers. Since the pay increase granted in 1920 the thriftless men have occupied positions in which their failure to report for duty has thrown others out of work; they have both added to the cost of coal by reducing the mine's production and done injury to numbers of the fellow workers and their families. This may be illustrated by the case of a cutting-machine runner whose failure to report for duty causes idleness of a dozen leaders the following day. About the mines there are many such key positions, and if one has not had practical experience it is hard to believe that such cases should occur as frequently as they do. In union operations it is a well-known fact that public opinion among the workers prevents the ambitious individual from doing more than the accepted average on the old and fallacious theory that to do more would take work away from someone else, losing sight of the fact that anything which tends to increase production and lower the cost thereof tends toward the reduction of the cost of living generally and means a greater purchasing power for the wage earner himself.

Labor Most Important Item of Cost

"Emphasis is put on the need of production in volume to decrease costs. The increase in productive capacity which we have had has been too widely distributed. Economically, conditions would be happier if the production were better concentrated and the mining units were fewer and larger. If the interferences which perpetuate speculative conditions in the coal markets could be removed, unrestricted competition would soon bring this about.

"The most important single factor of cost is the labor item with its 68 per cent of the whole. In conjunction with wise and skillful management and the progressive development of mechanical mining, labor can play a principal part in cutting fuel cost in the future. It was this combination in the non-union coal fields of the country which started the wheels of industry turning in the early part of 1922. Cheap power is dependent upon cheap fuel and cheap power is the talisman of industrial supremacy.

"The 8,400,000 wage earners of the country who are not engaged in mining coal cannot afford to protect the coal miner in the enjoyment of a special wage; they cannot wisely grant him a subsidy which will keep him in an industry at which he proposes to work but six hours a day five days a week. If they are inveigled into such a course by arguments of sentimentality or threats which arouse their fears they will find themselves supporting a policy and perpetuating an economic condition which will take from their children the wonderful opportunities for work, development and individual liberty which they inherited from their fathers. They are but paving the way to a future of socialistic indolence and misery in which the only persons with full stomachs will be those who succeed in ingratiating themselves with the little ring of astute political minds who can stay in control prior to the period of final chaos.

"The time will come again when the market price of coal will be based upon the cost of production, and then the industrial manager will have brought home his interest in the proper solution of the mine-labor problem, and he probably will be surprised to find how much the giant of irresponsible unionism has grown, and shocked to learn that he, the industrial manager, has supplied the wherewithal to make him grow."

Unionization Necessary for Stabilization, Say Union Officials

Union recognition and joint agreements provide the only way through which the coal industry can be stabilized, and stability is essential to the success of the industry, the United Mine Workers of America declares in a communication submitting "certain constructive suggestions concerning the coal industry" to the U. S. Coal Commission.

The communication consists of statements by Philip Murray, International vice-president of the union, and William Green, secretary-treasurer of the organization.

Mr. Murray says the U. S. Coal Commission by an aggressive, fearless attitude can compose all differences which exist in the unorganized coal-mining sections of the country and can further provide a peaceful and prosperous basis for collective bargaining which will govern the future procedure of the industry in those fields.

The only practical way in which this can be done, Mr. Murray contends, is to bring about for the non-union mining territory of this country working agreements which will safeguard properly the fundamental rights of mine workers and mine operators, protect the public and provide a just and reasonable basis for working relations and conditions. The safeguards which are essential to regularity of production and of peace and tranquility are:

"The guarantee of freedom of speech, freedom of assembly, freedom of movement.

"The right of all workers to organize and bargain collectively through representatives of their own choosing.

"The protection of mine workers against discrimination because of membership in the United Mine Workers of America or any other labor organization.

"The assurance that democratic institutions, such as the United Mine Workers of America, will not be subordinated to industrial control by the practice of the non-union coal operators in paying and controlling deputy sheriffs and constables or by employing private guards instead of using the services of distinterested, conscientious peace officers."

Admitting that the union does seek to organize the entire coal industry, Mr. Murray says its sole purpose is to seek uniformity of wages and working conditions and regularity and continuity of employment, and thereby to bargain collectively with the operators on terms approaching equality. Contending that all coal operators, including those in the non-union fields are organized, through membership in the National Coal Association, Mr. Murray, adds: "In all fairness, it should be possible for all the miners of the country, including those in the non-union fields, to be united in their national organization so that they may meet the maximum economic strength of the operators with the maximum economic strength of the mine workers."

At the same time Mr. Murray says: "We do not seek to control the coal industry, but we do demand a voice in its control. Advocates of the open-shop movement have taken as their slogan 'Those who pay should have the say.' Today the whole world knows that might does not make right but that right makes might, and we believe we are fundamentally and eternally right."

Mr. Murray declares the miners' organization stands for industrial peace, the stabilizing of conditions of employment and for the continuity and acceleration of production, while the non-union operators have nothing to offer except arbitrary action and industrial autocracy. The fruits of their policy, the statement says, are industrial and civil warfare.

Mr. Green's statement deals with collective bargaining and union recognition, and declares there can be no recognition of the principle of collective bargaining without a corresponding recognition of the right of the workers to organize into trade unions. To deny the workers the right to organize is nothing more, Mr. Green declares, than improper interference with the exercise of an inherent right and normal activities of a free people.

Notwithstanding the criticism emanating from some groups of people because of the coal strike of 1922, Mr. Green says there were only two failures to negotiate wage scales resulting in national suspensions during a period of twenty-three years in the anthracite and about thirty years in the bituminous-coal fields.

This record becomes the more remarkable, he says, when it is considered that these wage scales were negotiated through voluntary action on the part of coal operators and miners. "Joint wage agreements in effect for fixed periods of time between coal operators and miners serve to stabilize the industry and to guarantee an adequate coal supply. No interruption of mining operations because of a strike can take place during the life of the joint agreement. Such agreement, however, can only be successful through collective bargaining based upon union recognition.

"In coal fields where the miners are unorganized there can be no guarantee against strikes. The men employed in these sections are not parties to an agreement, are under no obligations to continue at work. Consequently they are free to cease work at any time. Especially is this true when the men employed in non-union territory become dissatisfied with the wages and conditions of employment arbitrarily fixed by their employer, and their desire to organize and for union recognition becomes strong."

As in every industry, Mr. Green says there are in the mining industry good and bad employers, none of which should have the authority arbitrarily to fix the wages and working conditions which their employees must accept. "Those who work and serve in industry are as essential to success as those who operate and manage the industry. Each has rights which the other should respect. Neither should become a dictator, because that would be autocracy in industry, something which is repugnant to the American sense of fair play."

Replying to the charge that may be made by those opposed to union recognition and collective bargaining, that if the mine workers were completely organized they would strike and paralyze the industries of the nation at will, Mr. Green said: "There could be no strike except at the termination of a contract period and then only in the event of a failure to agree upon a new wage agreement. The moral responsibility of the operators and miners would be so great and solemn that they could not, except in extreme emergency, refuse to agree upon the terms and conditions of a fair and reasonable wage scale."

Appellate Court Modifies McClintic Order Restraining Payment of Check-Off

The U. S. Circuit Court of Appeals at Richmond handed down a decision May 7 modifying the injunction of Judge George W. McClintic of the U. S. District Court for the southern district of West Virginia to the extent of eliminating that feature prohibiting the payment of check-off funds to the United Mines Workers. Judge McClintic's order had not only restrained the payment of the check-off but also enjoined the union from threatening or interfering or attempting to interfere in any manner whatsoever with employees of the Carbon Fuel Co. and 22 other mining companies in the Kanawha region.

In entering a modifying order, the appellate court to a great extent followed its action in the Borderland Coal Co. case. The one exception was as to the check-off, which the higher court permits to remain in force. Although the union is permitted to collect the funds derived from the check-off, the organization is not permitted to give or remit such money to striking miners who may be occupying houses on the property of the Carbon Fuel Co. and other plaintiff companies with a view to rendering assistance to such occupants so as to have them retain such occupancy in violation of the law. The appellate court continues to enjoin the United Mine Workers from aiding or abetting any person or persons to occupy or hold without rights any property of the plaintiffs by sending money or other assistance to be used by such persons in furtherance of such unlawful occupancy or holding.

Pending adjudication of the case on its merits in the district court, the injunction order of the appellate court is to remain in full force and effect.

THE OLD-FASHIONED religious revival depended on faith. And so does a business revival.—*Fresno Republican.*

Commission Probes Deeply Into Valuations, Royalties And Effect of Unionism on Productivity

By Paul Wooton
Washington Correspondent of *Coal Age*

That the President's Coal Commission is making more searching investigations than has been generally realized into the important matters of degradation of coal, productivity of labor under union and non-union conditions, establishment of fair valuations of mining properties, and of the royalty charges on coal lands was revealed on May 11 when Chairman Hammond, Governor Marshall, Dr. Devine, Dr. Smith and Mr. Howell, of the commission, discussed their work at the conference with representatives of the press.

It was the quality of anthracite rather than its price which gave rise to most of the complaints of last winter, Dr. Devine stated. He said the commission is anxious to receive suggestions as to the best procedure which will insure the receipt by the public of the quality of coal for which they are paying. He pointed out that some guarantee as to coal quality is in the interest of producers and dealers, as well as the ultimate consumer. The matter was discussed with the anthracite operators when they appeared before the commission. The operators expressed the opinion that there would be no difficulties arising from the quality of coal in normal times. Apparently, however, the commission expects to go deeply into the subject and is anxious to have opinion as to the advisability of leaving quality-control to the industry itself or whether government inspection is justified.

The anthracite operators seemed to have impressed the commission with their suggestion that prices to the ultimate consumer could be reduced materially were people to be less fastidious in their demand for "styles" of coal. They told the commission that there is no sound economic reason for the preparation of so many grades of anthracite. If the public would consent to a reduction of grades and will burn two grades together it would be possible for them to have more heat at a much less price, the commission was told. Governor Marshall advanced the opinion that the average householder would benefit were he to take a correspondence course in "Being One's Own Fireman." Dr. Smith admitted that some consumers are "more fussy than sensible."

Dr. Devine was positive in an assertion that the commission would have highly accurate information as to the productivity of labor under union and non-union conditions. This phase of the commission's inquiry is being conducted very carefully in the hope that the uncertainty will be removed from this much mooted point. Figures in that particular are being taken under a variety of working conditions.

In order to calculate the actual earnings of coal producers, accurate ideas as to property values must be available. Methods which are to be followed in the evaluation of coal mines are to be suggested by a committee of engineers which has consented to serve the commission in an advisory capacity. The personnel of the committee is as follows: R. V. Norris, Wilkes-Barre; H. M. Chance, Philadelphia; S. A. Taylor, Pittsburgh; J. H. Allport, Barnesboro, Pa., and James R. Finlay, of New York. This committee will serve the commission without compensation. These men were invited by the commission to do this work because of their long experience in the work of valuing mining properties. Several members of the committee have taken prominent parts in tax valuation work of various states.

Royalty charges were discussed with the anthracite operators and with Senator Pepper. In that connection, Governor Marshall announced that one of the best lawyers in Pennsylvania had been retained by the commission to advise as to the possibilities of fixing or limiting royalty charges. The commission is trying to ascertain to what extent the high royalties on the Girard holdings set the pace for royalty rates on other lands. Senator Pepper's statements in regard to royalties were general in character.

The anthracite operators committed themselves thoroughly to the policy of selling coal to any group of ultimate consumers willing to buy as much as a full carload. While this was not possible last winter, owing to the workings of the allocation plan, set up to insure equality in the distribution of the limited supply, the operators assured the commission that anthracite would be sold in carload units and shipped to any point where side-track facilities are available. This led several of the members of the commission to suggest that the way is open for any householder who is dissatisfied with his dealers' price to club together with three or four of his neighbors and purchase a carload of coal direct. One instance was cited where that plan had resulted in a saving of $6 a ton to the ultimate consumer.

In response to an inquiry from the Retail Coal Merchants' Association, the commission stated that it is committed to the advisability of the universal adoption of the short ton as the unit to be used in the coal trade.

Chairman Hammond stated that the discussion with the anthracite operators had been extended and had covered many of the important phases of the situation, but that the question of the wage agreement had not been broached as yet. He reiterated that the commission is particularly anxious to expedite these negotiations, so as to remove as quickly as possible the uncertainty which will surround anthracite until the new agreement is signed. He stated that the commission expects to confer with John L. Lewis within a few days and that further conferences with the anthracite operators will be held. No conclusions have been reached by the commission and none will be attempted until the representatives of the miners have been heard on each point in the presentation made by the anthracite operators.

The published article purporting to be an outline of the commission's anthracite report was described as fanciful fluff. It was stated positively that no draft of this report has been made and that the commission has no idea of attempting to formulate its report until it has heard finally from all concerned.

Merger of Northwestern Docks Begins

The Pittsburgh Coal Co. has "purchased a substantial interest" in the Milwaukee-Western Fuel Co., one of the largest dock interests on the upper Great Lakes. This announcement, together with the word that Alex B. Uhrig, president and director of the Milwaukee-Western, had resigned, was issued May 10 after a meeting of the directors of that company. This is the first definite news about the various dock mergers that have been rumored for weeks. It is now confidently expected by coal men that within a short time another great Northwest distributor will announce the absorption of several smaller dock companies.

Joseph W. Simpson, for years connected with the Milwaukee-Western, has been named to succeed Mr. Uhrig as president and will have direct charge of the business under the new régime. Mr. Uhrig declined to discuss his future plans.

The company operates ten dockyards in Milwaukee harbor, all of which are equipped with the most improved coal-handling machinery. From 2,000,000 to 3,000,000 tons of coal were received by lake annually by the company. The company also is interested in a fleet of steel steamers which are engaged in the coal and grain carrying trade.

Peter Reiss, of Sheboygan, Wis., head of the C. Reiss Coal Co., another of the principal Northwestern dock concerns, denies that his company is combined in the Pittsburgh-Milwaukee-Western consolidation. He had a hand in effecting the combine, but he was acting only as a director of the Pittsburgh Coal Co., he said.

In Kansas Everybody Is Willing for the Other Fellow to Remedy Coal Troubles

Manifestation of willingness for the other fellow to do something to put life in the Kansas coal market was the outstanding feature of the conference of operators, dealers, miners and railway officials in Topeka, May 10. Representatives of the miners expressed eagerness to support any move other than a reduction of wages. Retailers were willing to sponsor anything but a shaving of their own profits. The railroads favored anything but a reduction of freight rates. Operators declared they were producing coal at a loss right now. And E. T. Hackney, representing the Governor, who called the conference, had no reply to the suggestion of C. P. A. Clough, president of the Jackson-Walker Coal & Mining Co., that the state burn coal instead of oil in state institutions. The only point on which all were in accord was that the public should be encouraged to store its winter coal during the summer.

The conference was called by Governor Davis following his receipt of the report of Mr. Hackney, appointed by the Governor to investigate conditions in the southeastern Kansas field. Mr. Hackney found many mines closed, and others operating only one or two days a week. He found between 8,000 and 10,000 miners out of work.

His suggestions were passed on to the men at the Topeka conference, and, as has been indicated, each group was heartily in favor of the others putting them into effect. But Mr. Hackney had no suggestion for correcting the one thing above all others that is injuring the Kansas coal field—oil competition. Operators insist that lower freight rates and wage reductions alone can make it possible for them to lower prices to meet it.

Wage contracts have almost a year to run, so there is no possibility of immediate relief in that direction. But an attempt will be made to obtain lower freight rates from the Kansas field to the Missouri River at the hearing before the Interstate Commerce Commission in Kansas City starting May 17.

Strike Threat for Nationalization of Coal Mines Looms, Says Cornwell

John J. Cornwell, former Governor of West Virginia, told the members of the National Association of Manufacturers, in convention in New York City on May 16, that the coal miners are contemplating a nationalization of the mines, but that it was a question whether they would make the effort at the expiration of their present contract or wait until later.

"There is one thing of which I do feel certain," said Mr. Cornwell, "however, and to my mind it is just as sure as anything in the future can be, and that is that sooner or later, and I do not think it is very long off, the miners' organization will make an issue of the 'nationalization' of the coal mines and fight it out with a strike on that line.

"It is the basic demand of the United Mine Workers' organization and the officers are intent upon pressing it at the proper moment. There is a lull now, while the Government Fact Finding Commission makes its investigation, but if that commission's report is not satisfactory to them, and it will not be satisfactory unless it flatly advocates 'nationalization' of the mines, then the storm will break again and the agitation begin.

"If the United Mine Workers and those who agree with them—in other words, other organized labor groups—become powerful enough to force Congress to pass a bill 'nationalizing' the mines, they will also be powerful enough to fix the rates of pay as high as they like and to make the working conditions whatever they care to have them. And if, at any time, Congress should refuse or fail to enact the legislation demanded, it goes without saying that they would strike as quickly under government ownership and control as under private ownership and operation. So, there would be no relief coming from government ownership or 'nationalization' of the coal mines.

"It may be that the Coal Commission created by authority of Congress and now investigating all the phases of this question can find some method by which the industry can be stabilized and the situation improved, but, while I am not pessimistic about it, I am not very hopeful that it will be able to do so. I am rather inclined to the view that the large consumers, as a whole, might aid in stabilization were they willing and able to store a larger quantity of coal than they ordinarily do and thus stretch the production of coal over the entire year rather than have the demand come intermittently and sometimes fiercely, causing a great depression in the industry at certain seasons and unduly high prices at others, things which happen almost every year."

J. H. Sanford Disposes of $5,000,000 Coal Properties in Pittsburgh District

Bituminous coal properties in Washington and Allegheny counties, Pennsylvania, with an actual annual production of 3,000,000 tons, dock and yard sites and undeveloped or virgin coal lands in the Pittsburgh district are involved in the sale just completed by J. H. Sanford, of Pittsburgh, of his interests in the Carnegie Coal Co. and subsidiary corporations to John A. Bell, president of the Carnegie Trust Co. Five million dollars is said to be the price paid by Mr. Bell.

J. H. SANFORD

The following corporations and properties are included: the J. H. Sanford Coal Co., with mines at Racoon Station; the Carnegie Coal Co., with seven mines, at Oakdale, McDonald, Primrose, Racoon, Burgettstown, Atlasburg and Cedar Grove; the Pittsburgh & Lehigh Dock Co., with docks at Duluth, Minn.; the Carnegie Dock & Steel Co., operating at the Superior Dock, Superior, Wis.; the Chartiers Mining Co., with 44 acres of yard sites at Duluth, St. Paul and Minneapolis, Minn., and 1,500 acres of virgin coal lands, and the Carnegie Supply Co., with stores in Allegheny and Washington counties, Pennsylvania.

With this sale Mr. Sanford practically retires from a field in which he has been a dominating factor in the Pittsburgh district for over forty years, though he still retains his interest in the Chartiers Creek Coal Co., of which he is vice-president and which produces 500,000 tons annually of gas coal from operations near Cannonsburg in Washington County, Pennsylvania.

Under the name of the Jesse H. Sanford Co. he bought his first mine, the Leesdale, just above Carnegie in Allegheny County, Pennsylvania, at the age of twenty-eight. In 1899 his holdings had been increased to three mines, which were sold to the Pittsburgh Coal Co. The following year he bought 1,000 acres of coal land at Frederick, Pa., with Brown & Co., and at the same time organized the Carnegie Coal Co. with his father-in-law, the late R. P. Burgan. The latter sold his one-third interest a few years later to Mr. Bell, who now takes entire control of this corporation.

Northwest Dock Rate Decision, Expected July 1, May Bring Long List of New Complaints

It is now confidently expected by most interested parties that the Interstate Commerce Commission will return its decision in the Northwest dock rate cases, or at least the principal ones, by July 1. The hearing in Minneapolis on the dock operators' complaint of discriminatory rate relations ended May 8. Oral argument in Washington June 14 winds up the public action and leaves the commission free to arrive at its conclusion as soon thereafter as possible. It is prophesied by many midwesterners that the decision will be against any disturbance of the present rate schedules between the docks and inland Northwestern points and between Illinois and the same territory. However, if the commission orders southern Illinois rates changed, inevitably there will ensue a filing of many new complaints to secure new differentials between Illinois groups. Much tentative preparation is now being made.

The hearing ended Tuesday, May 8 with very little that was sensational on any hand. There was a little chance for grand stand play in the fact that the appeal for adjustment might have been for a reduction of lake-rail rates. This would have received considerable popular acclaim. Instead the situation was outlined by the docks as discriminatory and relief asked, the form to be left to the decision of the commission. It may be assumed that any relief based upon an increase in the rates from the all-rail fields would be received with vigorous and emphatic opposition from the general public in the Northwest as well as from public officials and politicians.

Various representatives of the Twin City coal dealers entered opposition against any move that would deprive them of the favorable all-rail rates now enjoyed and predicted that any adjustment which increased the all-rail rates would result in higher prices to the public.

A. J. Holmes, of the Holmes & Hallowell Co., stated that in North Dakota last winter 71 per cent of the fuel consumed was lignite, due to the high price of soft coal from Illinois and Indiana. A. J. Eckstrom, of the Flour City Fuel & Transfer Co., Minneapolis, testified in opposition to any increase in rates, stating that 75 per cent of his company's business was in Illinois or Indiana coal; 20 per cent dock coal and 5 per cent all-rail Eastern coal.

The railroads were generally opposed to any adjustment that involved any reduction in freight rates, on the ground of loss of revenue to themselves. Some of them did not indicate why they were so staunch for sustaining the low rates from the all-rail fields made by connecting lines, as against a lower rate from the docks, wherein they would have the entire revenue to themselves. They testified that any increase of the rates from Indiana and Illinois to the Northwest would result in forcing coal from those fields off the market in this territory.

A representative of the Minnesota Railroad and Warehouse Commission testified that any adjustment involving an increase of any rates now existing would be opposed as being bound to increase the cost to the consumer, and would also discourage industry. This position was supported by traffic experts from the St. Paul Association and from the Minneapolis Traffic Association.

Cross-examination of the carrier representatives brought out the admissions that the all-rail rates were favorable as compared with rates on other commodities, but they insisted that the railroads could not stand any loss of revenue.

Judge Berkey Permanently Enjoins Union In Somerset County

Judge John A. Berkey, in the Somerset County Court on Friday, May 11, after an all day hearing, made the injunction sought by the Quemahoning Creek Coal Co., operating mines at Harrison, Somerset County, Pa., permanent against the officers and members of the United Mine Workers, prohibiting the union from picketing and otherwise interfering with the company's operations.

The coal company has 200 men employed at Harrison, with whom it has a contract that they will not join the union during a fixed period. A temporary injunction was granted previously and the final hearing brought out important testimony to the effect that the union held meetings weekly in the vicinity of the mine; that the union organizers accosted non-union miners, appealing to them to "quit scabbing" and "join the strike." The defendants also were charged with contempt of the court's order of last year enjoining the congregating of strikers around mining property.

Reading Company Files Third Modified Plan Of Segregation; Government Objects

The Reading Company on May 10 filed a third modified plan of segregation with the U. S. District Court of Philadelphia providing an increase in the interest rate on the bonds to be issued by the segregated companies. The plan provides for the payment of 5 per cent interest on approximately $31,000,000 of new bonds on the company's property, instead of 4 per cent, and 4½ per cent interest on approximately $63,000,000 bonds to be issued by the Reading Company, instead of interest of 4 per cent, as heretofore provided. The new mortgage on the railroad will be known as an open-end mortgage, and the plan provides for the exchange of general mortgage bonds outstanding for one bond of Reading Company at 4½ per cent and one of the coal company at 5 per cent.

The coal bonds are to mature in fifty years and the railroad bonds will mature in seventy-four years.

The Attorney General has filed a brief in the Reading segregation case in which objection is made to certain provisions of the third modified plan. The government objects to increasing interest rate on the bonds on the ground that such additional charges would result in higher prices for coal. The government asks that the District Court determine the amount of compensation to be paid in cash.

Fuel Association Meeting Program Complete

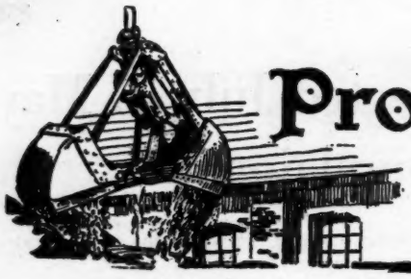
The program of the fifteenth annual convention of the International Railway Fuel Association, at Cleveland, Ohio, May 21-24, embraces a large number of speakers, who will discuss topics of pressing interest. T. K. Maher will welcome the visitors on behalf of the coal operators. Among those who will make addresses are Julius Kruttschnitt, George H. Cushing, whose subject will be "Classification of Coals"; C. E. Maurer, president Glens Run Coal Co.; H. M. Griggs, manager Ore & Coal Exchange, Cleveland, "Lake Coal Handling"; and C. S. Beyer, Jr., consulting engineer, Labor Bureau, Inc., "Incentives for Promoting Fuel Economy."

The local committee in charge of entertainment has announced a program of entertainment as follows:

Monday, May 21, afternoon, theater party for ladies at Keith's Palace theater; evening, Get-together reception at 7:30. Moving pictures of oil production and usage will be shown at 8:30 by courtesy of the Southern Pacific Co., followed by a dance.

Tuesday, May 22, afternoon, educational trip to American Steel & Wire Co.'s Newburg and Cuyahoga plants, or to coal- and ore-handling docks. Automobiles will be provided by Cleveland coal operators. In the evening the annual dinner and dance will be held.

Wednesday, May 23, noon, luncheon for ladies at Cleveland Art Museum, followed by a personally conducted tour of the museum and drive around Cleveland; evening, entertainment given by Cleveland coal operators.



Production and the Market

Weekly Review

Prices of soft coal have advanced a trifle from last week. Buying continues quiet but inquiries increased and there was an apparent attempt to buy at present prices for future delivery which is taken by operators and shippers as an inclination on the part of consumers to guard against future transportation difficulties.

Bituminous-coal output continues above 10,000,000 tons per week, although it has declined slightly during the past three weeks. Production so far this year is larger than for any similar period for six years.

Price changes show either up or down in all districts except Mt. Olive and Pittsburgh. The greatest advance was made by Cambria, Somerset and Clearfield coals, with Pocahontas following closely. The biggest drop was in Kanawha coals. *Coal Age* Index of spot prices for bituminous coals was 226 on May 14, as compared with 220 for the previous week, with an average price of $2.73.

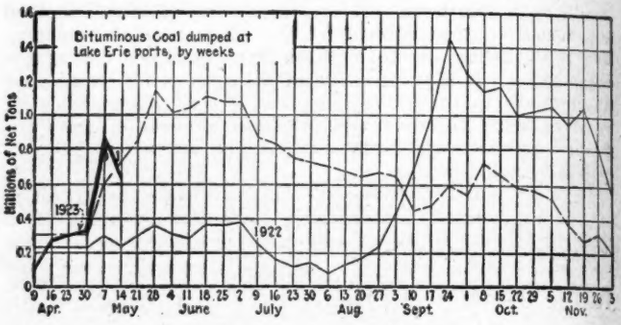
Mine Closings Continue in Middle West

More mines closed in the Midwest, causing spot prices in these districts to advance a trifle. In the East there is considerable optimism and operators feel confident that fuel stocks are low. Warnings issued by the Department of Commerce and by organizations, including the Chamber of Commerce of the United States, to consumers to buy coal now have resulted in more inquiries and while few orders have been placed producers and shippers are hopeful. There is a strong feeling that industrial plants are preparing to store.

Contracting has taken on new life and some contracts were reported closed. The U. S. Shipping Board opened bids last week for furnishing 1900 gross tons of either Pool 9 or 71 coal alongside New York harbor and received tenders ranging from $5.43 to $7. Contracts for small tonnages for industrial plants were closed on a basis of $3.25 per net ton f.o.b. mine for Pool No. 9, and at $3 per net ton f.o.b. mine for Pool 10 coal.

The export market continues flat. There were some inquiries but no definite business was reported. A couple of charters for French Atlantic destinations for old business were reported. Shipments from Baltimore during the first seven days of May amounted to 73,526 tons of cargo and bunker coal, and 26,780 tons of coke, a total of 100,306 tons of coal and coke.

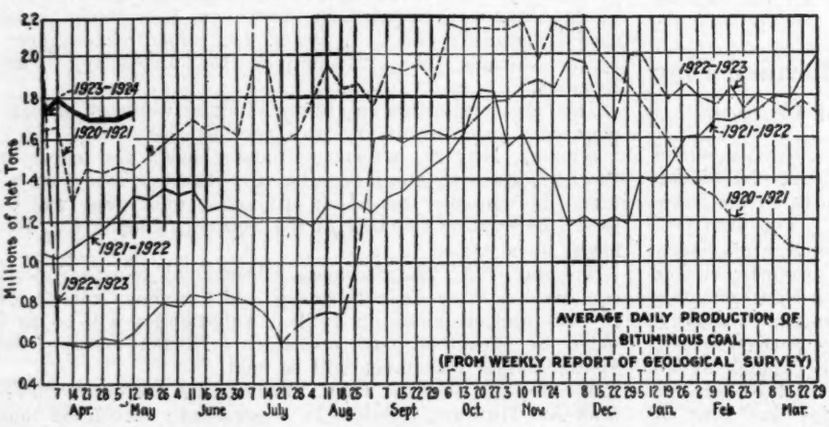
A shipment that attracted considerable interest in Baltimore took place on May 11, when the steamship Winnebago loaded 5,229 tons of smithing coal for Portland and Seattle. This shipment is looked upon as the



start of further shipments to the Pacific coast by way of the Panama Canal. The vessel took bunker coal at Norfolk.

The Lake season has opened in nearly all directions. Shipments are heavy, close to a half million tons having arrived at the Head-of-the-Lakes during the first week of navigation.

"For the third successive week production of soft coal declined slightly," says the Geological Survey. "The total output in the week ended May 5 is estimated at 10,010,000 net tons, a decrease of 93,000 tons from the figure for the week preceding. May Day was partially observed as a holiday in some districts, and over the country as a whole it appears that it counted for about



Estimates of Production

(Net Tons)

	1922	1923
BITUMINOUS		
April 21 (*b*)	3,575,000	10,221,000
April 28 (*b*)	4,175,000	10,103,000
May 5 (*a*)	4,164,000	10,010,000
Daily average	694,000	1,668,000
Calendar year	148,693,000	189,506,000
Daily av. cal. year	1,396,000	1,776,000
ANTHRACITE		
April 21	6,000	2,065,000
April 28	5,000	2,116,000
May 5	6,000	2,021,000
Calendar year	21,809,000	35,739,000
COKE		
April 28 (*b*)	94,000	338,000
May 5 (*a*)	95,000	406,000
Calendar year	2,400,000	6,824,000

(*a*) Subject to revision. (*b*) Revised from last report.

90 per cent of a full working day. Preliminary reports of cars loaded during the week of May 7-12 indicate slightly better conditions and it seems probable that production will total about 10,200,000 tons."

Dumpings at Hampton Roads during the week ended May 10 for all purposes totaled 359,002 net tons, as compared with 355,271 net tons in the previous week.

Production of anthracite continues on a basis of about 2,000,000 tons weekly. Domestic sizes are scarce, with demand heavy. Considerable coal is going into Canada. The steam sizes are slowing up, some producers sending heavy tonnages to storage, which enables the independent operators to dispose of their output to better advantage.

Midwest Slowly Slogs Along

The Midwest coal region is slogging along more and more slowly. A few more mines in both Indiana and Illinois have shut down, many of them for the summer. In central Illinois so few mines are operating that little but contract mine-run is shipped and as a result screenings are scarce. The spot price has risen a little as a consequence, but nobody needs to buy. Southern Illinois, gathering in about all the domestic business the state gets just now, is shipping enough lump and egg to bring out a steady flow of steam coals of ample volume to meet most requirements. losing only a little bit of rush steam business to the Springfield district.

Franklin County, though nearly half shut down and getting but 40 per cent running time for the other half, is preparing for an advance in domestic price June 1 from $4.10 to $4.35. The big operators insist they are going through with the plan of advancing the price 25c. a month throughout the summer, and that there will be few deviations. Just now there are a good many independents in the Carterville region offering lump, egg and nut at $2.75 @$3 and some of last month's orders have been extended by the bigger shippers at the April price of $3.85.

The Duquoin and Jackson County fields are shipping a little domestic up to $3.50 and screenings at $1.60. Mt. Olive district is almost at a standstill.

St. Louis "Quiet and Easy"

The St. Louis market is "quiet and easy." A little anthracite and smokeless is placed right along and there is not enough coke to meet a slow demand. However, there is

Current Quotations—Spot Prices, Bituminous Coal—Net Tons, F.O.B. Mines

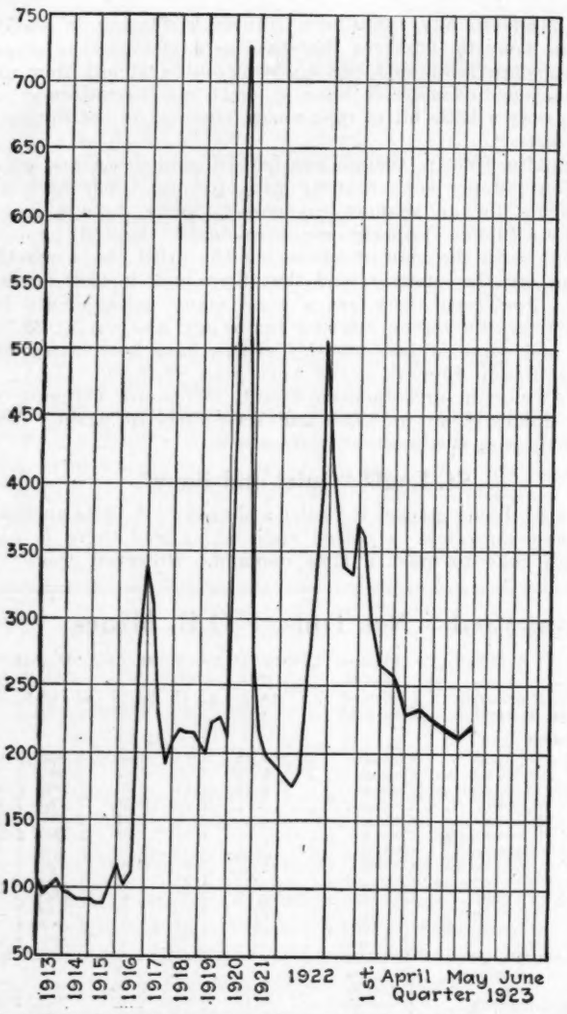
	Market Quoted	May 15 1922	Apr. 30 1923	May 7 1923	May 14 1923†
Low-Volatile, Eastern					
Smokeless lump	Columbus	$2.85	$6.10	$6.15	**$6.00@$6.50**
Smokeless mine run	Columbus	2.90	4.10	4.00	**3.85@ 4.35**
Smokeless screenings	Columbus	2.90	4.00	3.75	3.50@ 4.00
Smokeless lump	Chicago	2.90	6.10	6.10	6.00@ 6.25
Smokeless mine run	Chicago	2.70	3.85	3.85	3.75@ 4.00
Smokeless lump	Cincinnati	3.25	6.00	6.00	6.00
Smokeless mine run	Cincinnati	2.90	3.85	3.85	**4.00@ 4.50**
Smokeless screenings	Cincinnati	2.75	3.85	3.85	**4.00@ 4.25**
*Smokeless mine run	Boston	6.75	6.35	6.35	**6.75@ 7.00**
Clearfield mine run	Boston	3.25	2.60	2.50	**2.25@ 3.25**
Cambria mine run	Boston	3.75	3.35	3.10	**3.25@ 4.00**
Somerset mine run	Boston	3.50	3.00	2.75	**2.75@ 3.50**
Pool 1 (Navy Standard)	New York	.....	4.00	3.75	3.50@ 4.00
Pool 1 (Navy Standard)	Philadelphia	3.95	4.05	4.05	*3.80@ 4.20*
Pool 1 (Navy Standard)	Baltimore	4.00	.....	.....	.....
Pool 9 (Super. Low Vol.)	New York	4.00	3.10	2.80	**2.60@ 3.25**
Pool 9 (Super. Low Vol.)	Philadelphia	3.75	3.10	3.05	*2.70@ 3.35*
Pool 9 (Super. Low Vol.)	Baltimore	4.00	2.90	2.80	*2.65@ 2.85*
Pool 10 (H.Gr.Low Vol.)	New York	3.75	2.60	2.50	2.25@ 2.75
Pool 10 (H.Gr.Low Vol.)	Philadelphia	3.60	2.50	2.45	*2.20@ 2.60*
Pool 10 (H.Gr.Low Vol.)	Baltimore	3.75	2.50	2.25	2.25
Pool 11 (Low Vol.)	New York	3.65	2.25	2.20	1.90@ 2.50
Pool 11 (Low Vol.)	Philadelphia	.....	2.10	2.00	1.85@ 2.20
Pool 11 (Low Vol.)	Baltimore	3.50	2.15	2.00	2.00
High-Volatile, Eastern					
Pool 54-64 (Gas and St.)	New York	.....	1.80	1.80	**1.75@ 2.00**
Pool 54-64 (Gas and St.)	Philadelphia	.....	2.05	1.85	1.75@ 2.00
Pool 54-64 (Gas and St.)	Baltimore	.....	1.95	1.80	1.80
Pittsburgh sc'd gas	Pittsburgh	.....	2.85	2.85	2.75@ 3.00
Pittsburgh mine run (St.)	Pittsburgh	.....	2.00	2.00	2.00
Pittsburgh slack (Gas)	Pittsburgh	.....	1.60	1.75	1.75
Kanawha lump	Columbus	3.15	3.60	3.50	*3.00@ 3.50*
Kanawha mine run	Columbus	3.00	2.25	2.25	*2.00@ 2.40*
Kanawha screenings	Columbus	2.95	2.10	2.05	*1.60@ 1.90*
W. Va. lump	Cincinnati	3.10	3.75	3.50	**3.09@ 4.50**
W. Va. Gas mine run	Cincinnati	3.00	2.40	2.35	*1.90@ 2.50*
W. Va. Steam mine run	Cincinnati	3.00	2.40	2.35	*1.90@ 2.50*
W. Va. screenings	Cincinnati	2.90	2.25	2.10	*1.75@ 2.25*
Hocking lump	Columbus	3.15	2.85	2.85	*2.60@ 3.00*
Hocking mine run	Columbus	2.90	2.00	1.95	1.85@ 2.10
Hocking screenings	Columbus	2.85	1.70	1.60	1.50@ 1.75
Pitts. No. 8 lump	Cleveland	3.25	2.85	2.90	2.35@ 3.50
Pitts. No. 8 mine run	Cleveland	3.25	2.15	2.15	$2.10@$2.25
Pitts. No. 8 screenings	Cleveland	3.25	1.80	1.80	*1.50@ 1.75*
Midwest					
Franklin, Ill. lump	Chicago	3.95	3.65	3.80	3.50@ 4.10
Franklin, Ill. mine run	Chicago	4.15	3.10	3.10	3.00@ 3.25
Franklin, Ill. screenings	Chicago	4.15	1.85	1.85	*1.60@ 1.90*
Central, Ill. lump	Chicago	.....	2.70	2.30	2.25@ 2.35
Central, Ill. mine run	Chicago	.....	2.10	2.10	2.00@ 2.25
Central, Ill. screenings	Chicago	.....	1.55	1.55	**1.75@ 2.00**
Ind. 4th Vein lump	Chicago	.....	3.35	3.35	3.25@ 3.50
Ind. 4th Vein mine run	Chicago	.....	2.85	2.85	2.75@ 3.00
Ind. 4th Vein screenings	Chicago	.....	1.85	1.85	1.75@ 2.00
Ind. 5th Vein lump	Chicago	.....	2.85	2.85	2.75@ 3.00
Ind. 5th Vein mine run	Chicago	.....	2.10	2.10	2.00@ 2.25
Ind. 5th Vein screenings	Chicago	.....	1.55	1.55	**1.60@ 1.75**
Standard lump	St. Louis	.....	2.50	2.50	**2.50@ 2.75**
Standard mine run	St. Louis	.....	1.85	1.85	*1.75@ 1.90*
Standard screenings	St. Louis	.....	1.10	1.50	1.50
West Ky. lump	Louisville	3.15	2.60	2.60	2.50@ 2.75
West Ky. mine run	Louisville	3.15	1.95	1.90	1.85@ 2.00
West Ky. screenings	Louisville	3.15	1.85	1.75	*1.50@ 1.75*
West Ky. lump	Chicago	.....	2.60	2.60	2.50@ 2.75
West Ky. mine run	Chicago	.....	1.80	1.80	1.75@ 1.85
South and Southwest					
Big Seam lump	Birmingham	2.00	2.50	2.70	2.70
Big Seam mine run	Birmingham	1.70	2.10	2.05	1.85@ 2.25
Big Seam (washed)	Birmingham	1.95	2.35	2.35	2.25@ 2.50
S. E. Ky. lump	Chicago	.....	3.75	3.75	3.50@ 4.00
S. E. Ky. mine run	Chicago	.....	2.85	2.85	2.75@ 3.00
S. E. Ky. lump	Louisville	3.15	4.00	4.10	*3.50@ 4.50*
S. E. Ky. mine run	Louisville	3.00	2.75	2.45	**2.25@ 2.75**
S. E. Ky. screenings	Louisville	3.00	2.25	1.90	1.80@ 2.00
S. E. Ky. lump	Cincinnati	3.00	3.50	3.35	2.75@ 4.00
S. E. Ky. mine run	Cincinnati	3.00	2.25	2.25	1.75@ 2.25
S. E. Ky. screenings	Cincinnati	3.00	2.00	2.00	*1.60@ 2.00*
Kansas lump	Kansas City	4.25	3.85	3.85	3.25@ 4.50
Kansas mine run	Kansas City	4.15	3.25	3.25	3.00@ 3.50
Kansas screenings	Kansas City	2.65	2.60	2.60	2.50@ 2.75

* Gross tons, f.o.b. vessel, Hampton Roads.
† Advances over previous week shown in **heavy type**, declines in *italics*.

Current Quotations—Spot Prices, Anthracite—Gross Tons, F.O.B. Mines

	Market Quoted	Freight Rates	Latest Pre-Strike Independent	Latest Pre-Strike Company	May 7, 1923 Independent	May 7, 1923 Company	May 14, 1923† Independent	May 14, 1923† Company
Broken	New York	$2.34	.....	$7.60@$7.75	.....	$7.75@$8.35	.....	$7.75@$8.35
Broken	Philadelphia	2.39	$7.00@$7.50	7.75@ 7.85	.....	7.90@ 8.10	.....	7.90@ 8.10
Egg	New York	2.34	7.60@ 7.75	7.60@ 7.85	$8.50@11.00	8.00@ 8.35	$8.50@11.00	8.00@ 8.35
Egg	Philadelphia	2.39	7.25@ 7.75	7.75	9.25@ 9.50	8.10@ 8.35	9.25@ 9.50	8.10@ 8.35
Egg	Chicago*	5.09	7.50	8.25	12.00@12.50	7.20@ 8.25	12.00@12.50	7.20@ 8.25
Stove	New York	2.34	7.90@ 8.20	7.90@ 8.10	8.50@11.00	8.00@ 8.35	8.50@11.00	8.00@ 8.35
Stove	Philadelphia	2.39	7.85@ 8.10	8.05@ 8.25	9.25@ 9.50	8.15@ 8.35	9.25@ 9.50	8.15@ 8.35
Stove	Chicago*	5.09	7.75	8.25	12.00@12.50	7.35@ 8.25	12.00@12.50	7.35@ 8.25
Chestnut	New York	2.34	7.90@ 8.20	7.90@ 8.20	8.50@11.00	8.00@ 8.35	8.50@ 11.00	8.00@ 8.35
Chestnut	Philadelphia	2.39	7.85@ 8.10	8.05@ 8.15	9.25@ 9.50	8.15@ 8.35	9.25@ 9.50	8.15@ 8.35
Chestnut	Chicago*	5.09	7.75	8.25	12.00@12.50	7.35@ 8.35	12.00@12.50	7.35@ 8.35
Ranges	New York	2.34	.....	.....	.....	8.30	.....	8.30
Pea	New York	2.22	5.00@ 5.75	5.75@ 6.45	6.30@ 7.25	6.00@ 6.30	6.30@ 7.25	6.00@ 6.30
Pea	Philadelphia	2.14	5.50@ 6.00	6.10@ 6.25	7.00@ 7.25	6.15@ 6.20	7.00@ 7.25	6.15@ 6.20
Pea	Chicago*	4.79	6.00	6.25	7.00@ 8.00	5.49@ 6.03	7.00@ 8.00	5.49@ 6.03
Buckwheat No. 1	New York	2.22	2.75@ 3.00	3.50	2.25@ 3.50	3.50@ 4.15	2.25@ 3.50	3.50@ 4.15
Buckwheat No. 1	Philadelphia	2.14	2.75@ 3.25	3.50	3.00@ 3.50	3.50	3.00@ 3.50	3.50
Rice	New York	2.22	2.00@ 2.50	2.50	1.60@ 2.50	2.50	*1.50@ 2.50*	2.50
Rice	Philadelphia	2.14	2.00@ 2.50	2.50	2.00@ 2.50	2.50	2.00@ 2.50	2.50
Barley	New York	2.22	1.50@ 1.85	1.50	1.00@ 1.50	1.50	1.00@ 1.50	1.50
Barley	Philadelphia	2.14	1.50@ 1.75	1.50	1.15@ 1.50	1.50	1.15@ 1.50	1.50
Birdseye	New York	2.22	.....	2.00@ 2.50	1.50@ 1.60	1.60	.....	1.60

*Net tons, f.o.b. mines †Advances over previous week shown in **heavy type**, declines in *italics*.



Coal Age Index 226, Week of May 14, 1923. Average spot price for same period $2.73. This diagram shows the relative, not the actual prices on fourteen coals, representative of nearly 90 per cent of the bituminous output of the United States weighted first with respect to the proportions each of slack, prepared and run-of-mine normally shipped, and second, with respect to the tonnage of each normally produced. The average thus obtained was compared with the average for the twelve months ended June, 1914, as 100, after the manner adopted in the report on "Prices of Coal and Coke, 1913, 1918," published by the Geological Survey and the War Industries Board.

little else doing on that market except a thin, but steady Standard district steam trade. Buyers will not believe that coal is going to go up during the summer. They appear to be waiting for another drop. One reason for this attitude is that the retailers failed to make good on their hint that they would raise prices May 1 when the field circular on many domestics went up 25c.

Kentucky Mildly Active

Eastern Kentucky is doing a little business every week but the desired rush of Lake trade has not been strong enough to create any furor. Industrial consumption and railroad business is light. Business generally is quite fair. The western end of the state, having recently settled its strike, is harder put for trade than the Harlan and Hazard fields because little of that coal goes to the Lakes, and it is difficult for it to penetrate the Chicago and Midwestern market because of Illinois and Indiana competition. Steam coal is generally draggy and not much activity is expected by most operators before the middle of June or the first of July. Prices have shown no marked change.

Northwest Wide Awake Now

Navigation opened with a rush at the Head-of-the-Lakes. It is the second latest opening of record, according to Duluth historians.

The new list of prices has been announced. They range as a whole about $2 below last year's opening: Kentucky lump, $8; splint lump, $7.50; Youghiogheny lump, $7; Hocking lump, $6.75; Youghiogheny & Hocking run of pile, $6; Youghiogheny screenings, $4.50; Hocking screenings, $4.25; Pocahontas lump, $12.50; mine run, $9; screenings, $6.75. Other prices have not been announced. Anthracite is selling at last year's figures. It is expected that prices will be announced at the end of this week.

The Milwaukee market is very quiet though the sharp reduction in price of Eastern bituminous coal on May 1 had the effect of stimulating buying in industrial circles to some extent. In addition to the arrival of forty-three cargoes of coal, car ferries brought in 18,427 tons of anthracite and 80,176 tons of soft coal during the month of April. The railroads contributed no anthracite, but delivered 109,612 tons of soft coal.

Western Business Quiet

Colorado bituminous producers had a fair week with no recessions in prices but the pick-up in their business was slight. There is a real demand both for bituminous and lignite slack at fair prices, not because the demand is stronger than usual at this time of year but because there is less coal screened now than is normal.

Business for Utah mines remains quiet. Weather is warm and working time has dropped so low that many experienced miners are leaving the field. Prices continue to fluctuate.

In the region around Kansas City, field prices have not changed and the situation is in no way improved over that of the last few weeks. Nobody is buying for storage. Householders are not taking advantage of slight reductions in retail prices and industrial consumers and railroads assert that Kansas coal will not store, hence they would be foolish to try it. The industrial contract market remains fairly steady, however.

Ohio Markets Show Little Change

Trade is quiet in the Columbus market. Buying for steam purposes is at a minimum and the general prosperity in industrial circles is not reflected in the coal trade. Large users are using their reserve stocks and show little inclination to come into the market. In the Cincinnati market the lower grades were kept moving by low prices, with better grades holding their own. A little spurt that resulted in better car supply in the Pocahontas fields is said to have been responsible for a better market for those coals. Operators and jobbers in the Cleveland market say that the general steam demand is no better than it has been for some weeks.

Demand for gas coal in the Pittsburgh district continues of fair proportions but there is no snap to the market. The utilities are running as well as usual at this time of the year, while the steel industry, which consumes considerable gas coals is running at a new high record rate.

In central Pennsylvania the new mine ratings under recently established distribution rules became effective on the Pennsylvania R.R. on May 10 and are being watched by operators. Under the new ratings some companies will get more cars and others less. Production during April in central Pennsylvania was 69,567 cars as compared with 79,542 cars in March.

Consumers in the Buffalo market see no reason for buying coal when supply is greater than the demand.

New England Markets Apathetic

The leading feature in the New England market is the distinctly firmer trend of Hampton Roads prices. With a relatively small output there has been enough increase in buying to warrant higher quotations f.o.b. vessel, but not only is there no improvement in demand at various rehandling plants but there seem few indications of prices any higher than those that have prevailed for nearly sixty days. Purchases continue on a hand-to-mouth basis and not yet have buyers generally shown any disposition to place orders more than a month or two in advance. Reserves are of only moderate size, but water power is ample in large areas and there continues the same apathetic attitude toward coal

that has been characteristic since quotations began to recede earlier in the year.

Higher prices at the Virginia terminals resulted in slightly better inquiry for Pennsylvania coal, although thus far what small business has come into the market has been confined almost exclusively to the choice grades. Even these have sold at what operators regard as bottom figures, costs considered, but frequent embargoes which shut off deliveries on contract also have had their bearing. At one time recently all five of the Hudson River gateways were practically closed to bituminous coal and shippers were obliged to send output temporarily in directions where coal does not usually flow in such volume. Part of the depression in Pennsylvania quotations the past week has been due to this factor.

While tonnage for transshipment at New York and Philadelphia is by no means heavy the aggregate for May probably will show an increase over totals for April. Transportation conditions by rail, of course, have contributed to tidewater movement. A considerable share of the coal actually dumped is for gas-making purposes and for railroad fuel, and there also is a certain amount that continues to go forward to points not easily accessible from Hampton Roads. Coastwise freights are easy at $1, Hampton Roads to Boston, on large vessels and barges, with steamers at 90@95c.

Slow Demand in New York Market

In New York demand was slow. Some operators assert that they are sold up for certain grades well into June while others complain of lack of business. Inquiries are on the increase, however, and operators and shoppers are optimistic. There were 3,400 cars at the local terminals on May 12. Philadelphia consumers are unwilling to buy anything out of the ordinary. Feelers have been put out by some consumers on big blocks of coal to run from one to two months. The feature of the Baltimore market centers in the export situation. Local demand is slow.

Lack of market for steam coal is serving gradually to reduce production in the Alabama field. Many mines dependent almost entirely upon spot demand are either closed or have curtailed production considerably.

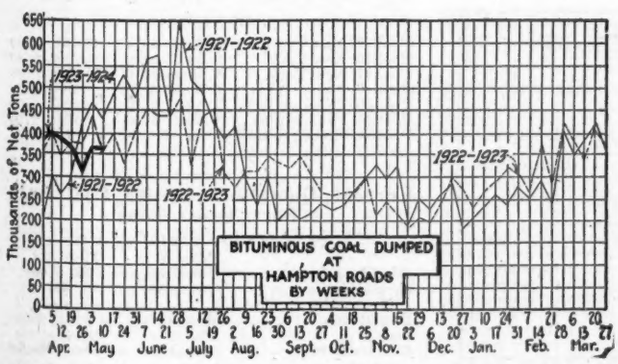
Lake Navigation Gains Strength

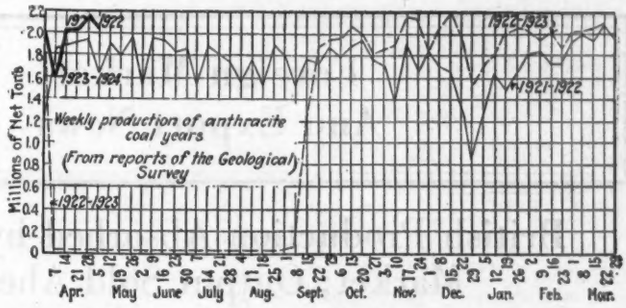
Lake navigation, while not active from all ports, is gaining strength. More than 500,000 tons of coal have arrived at Duluth since May 5, when the first shipment was received, among it some anthracite, and other cargoes of hard coal are reported on the way. Arrivals at Milwaukee during the first ten days of May consisted of 80,629 tons of anthracite and 281,761 tons of soft coal. In the Columbus market the Lake trade is expected to be under full headway the latter part of May. Loading of bottoms is going on briskly.

During the week ended May 14 Lake dumpings amounted to 582,486 net tons of cargo coal and 23,525 net tons of fuel coal, making the season's dumpings to date 2,376,169 net tons of cargo coal and 94,277 net tons of fuel coal.

Strong Demand for Domestic Anthracite

Anthracite domestic sizes are readily absorbed. Demand is strong and in the New York market egg and stove sizes are in greatest call. Large tonnages are going to the Northwest as well as into Canada.





"The production of anthracite was well maintained during the first week of May," says the Geological Survey, "even though there was a slight decline in output. The nine principal anthracite carriers reported loading 38,643 cars, from which it is estimated that the total output, including mine fuel, local sales, and the product of dredges and washeries, was 2,021,000 net tons.

"Preliminary reports of loadings during the week May 7-12 indicate a higher rate of production during the week."

Production of Coke Declines Slightly

Production of coke in April was 3,206,000 net tons, as compared with 3,256,000 net tons in March, says the Geological Survey. To manufacture this tonnage of coke it is estimated that 7,408,000 tons of coal was consumed, of which 4,607,000 tons were used in byproduct ovens and 2,801,000 tons in beehive ovens. During the week ended May 5 the total output is estimated at 406,000 net tons, a decrease of 18,000 tons as compared with the week previous.

F. R. WADLEIGH, FEDERAL FUEL DISTRIBUTOR, has requested the National Retail Coal Merchants' Association and the American Wholesale Coal Association each to name a representative from its organization for membership on his Advisory Committee to study community coal storage, coal sales agencies and distribution.

How the Coal Fields Are Working

Percentages of full-time operation of bituminous coal mines, by fields, as reported by the U. S. Geological Survey in Table V of the Weekly Report.

	Jan. 1 to Apr. 1. 1922 Inclusive	Sept. 5 to Dec. 30, 1922 Inclusive	Jan. 1 to Apr. 28, 1923 Inclusive	Week Ended April 28, 1923
U. S. Total	55.7	....	....	....
Alabama	64.6	84.7	89.0	(a)
Somerset County	74.9	36.3	32.5	(a)
Panhandle, W. Va.	51.3	57.3	55.7	58.2
Westmoreland	58.8	65.8	56.3	61.3
Virginia	59.9	55.7	56.3	65.3
Harlan	54.8	22.1	23.9	29.0
Hazard	58.4	16.4	23.6	39.3
Pocahontas	60.0	36.6	38.2	38.7
Tug River	63.7	28.8	35.9	43.4
Logan	61.1	26.2	31.4	38.2
Cumberland-Piedmont	50.6	31.7	49.2	54.2
Winding Gulf	64.3	30.4	35.3	42.0
Kenova-Thacker	54.3	42.4	35.8	49.9
N. E. Kentucky	47.7	28.4	28.4	34.1
New River	37.9	31.6	36.7	42.1
Oklahoma	59.6	59.1	44.0	54.3
Iowa	78.4	75.9	74.7	43.6
Ohio, Eastern	46.6	40.8	36.0	39.7
Missouri	66.8	76.3	72.1	50.0
Illinois	54.5	49.9	45.6	33.2
Kansas	54.9	55.9	46.4	40.9
Indiana	53.8	37.7	50.3	37.2
Pittsburgh†	39.8	41.2	36.2	51.1
Central Pennsylvania	50.2	53.4	48.5	55.0
Fairmont	44.0	35.5	36.4	44.5
Western Kentucky	37.7	32.4	32.4	25.2
Pittsburgh*	31.9	56.1	60.5	73.9
Kanawha	13.0	15.6	23.5	25.9
Ohio, Southern	24.3	38.1	31.5	24.1

* Rail and river mines combined.
† Rail mines.
(a) No report.

Car Loadings, Surplusages and Shortages

	Cars Loaded All Cars	Cars Loaded Coal Cars
Week ended April 28, 1923	963,694	180,127
Previous week	957,743	179,762
Same week in 1922	751,111	75,389

	Surplus Cars All Cars	Surplus Cars Coal Cars	Car Shortage	
April 30, 1923	13,556	2,849	35,282	17,634
Same date in 1922	371,764	229,892	....	....
April 22, 1923	11,062	2,582	44,299	20,725

Foreign Market And Export News

British Production Absorbed by Active Market; Output Sold Ahead

During the week ended April 28, Great Britain's mines produced 5,721,000 tons of coal, says a cable to *Coal Age*. This is a decrease of 104,000 tons from the output of the previous week, but within 21,000 tons of the weekly record output for 1922.

The Welsh coal trade, compared with its condition of a few weeks back, has become irregular. The unsettled state of other British markets has not yet affected Newcastle. Production of all classes of coal is now sold up for weeks to come, and it is not believed there can be no appreciable falling off in the volume and value of trade until July 1.

For the period ending June there is an active inquiry. Sellers ask for full rates, and get them without any difficulty. Supplies are very scarce all around, particularly in coking coals.

Efforts to reach a settlement of the question of the three-shift operation at the Welsh coal ports have not been successful. Following the refusal of the coal tippers and trimmers to accept the provisional agreement made with the operators, attempts have been made to secure a guarantee that the present high earnings, ranging from £6 to £9 per week will continue in force, but the operators decline to give any such guarantee. The Industrial Court appointed to inquire into the position will not resume its sittings until a deadlock in the negotiations is reported.

Statistics of the Board of Trade on coal exports for the month of April compared with the same month of 1922, follow, in tons:

	1923	1922
Germany	1,715,000	257,000
France	1,543,000	955,000
Italy	754,000	541,000
Other countries	2,829,000	2,343,000
Total	6,841,000	4,096,000

Export Demand at Hampton Roads Strong

Business at Hampton Roads had a livelier tone last week, with export trade booming and threatening to break all records for the past twelve months. A pick-up in trade with France and South America was one of the outstanding features of the market.

Stocks at the piers were cut down, and prices stiffened. The Norfolk & Western R.R. routed a large tonnage by rail to the West, and the result was reflected in diminished stocks at the piers. Coastwise trade was on the decline, but the bunker business held firm.

A generally optimistic tone was heard throughout the trade, with prospects for increasing business bright. Export trade is expected to continue to grow. Domestic business was falling off to the usual season's minimum. The car situation was improved, being about 75 per cent of normal, from the best opinion in the trade.

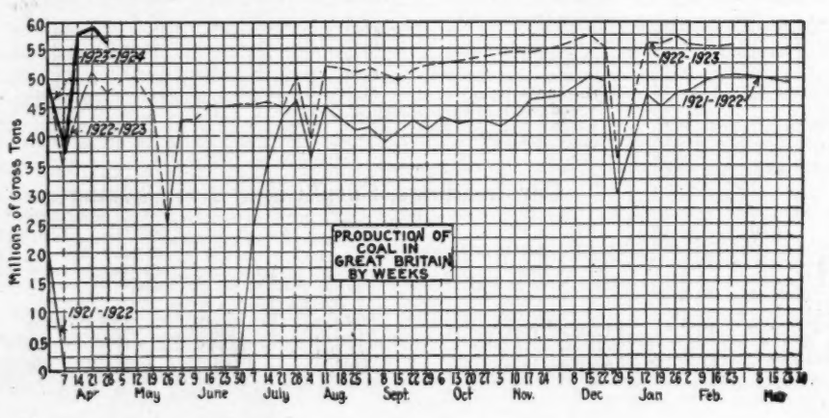
Export Clearances, Week Ended May 5, 1923

FROM HAMPTON ROADS

	Net Tons
For Brazil:	
Grk. SS Maria Stathatos, for Rio de Janeiro	6,013
Br. SS Sallust, for Pernambuco	1,986
For Canada:	
Du. SS Tenbergen, for Three Rivers	6,994
Nor. SS Corona, for St. Johns	5,022
For Egypt:	
Br. SS City of Adelaide, for Port Said	2,569
For France:	
Ital. SS Livenza, for Marseilles	8,124
Br. SS Kastalia, for Marseilles	6,729
Br. SS Sedgepool, for Havre	8,543
Br. SS Hindustan, for Havre	7,444
Br. SS Bakana, for Marseilles	6,560
For Germany:	
Br. SS Maid of Psara, for Hamburg	5,436
For Greece:	
Ital. SS Salina, for Piraeus	8,061
For Holland:	
Du. SS Uredenburh, for Rotterdam	10,395
Du. SS Flensburg, for Rotterdam	9,918
For Porto Rico:	
Amer. SS Evelyn, for San Juan	3,994
For Uraguay:	
Br. SS Trevarrack, for Montevideo	6,371
For Venezuela:	
Amer. Schr. Mabel A. Frye, for Tucacas	1,936
For West Indies:	
Br. SS Elswick Tower, for Fort de France	5,719

FROM PHILADELPHIA

For Brazil:	
Br. SS Sweethope, for Bahia Blanca	....
For France:	
Br. SS Halesius, for Dunkirk (coke)	2,903
Nor. SS Loch Tay, for Dunkirk (coke)	3,182



French Coal Imports and Exports

IMPORTS

Coal	March	Three Months
Sarre	4,432	499,692
Great Britain	1,729,418	4,134,642
Belgium	177,857	545,414
Germany	46,661	354,414
Spain	30	828
Netherlands	64,159	135,272
Other countries	130	1,685
Totals	2,022,687	5,671,951
Coke		
Great Britain	55,242	157,638
Belgium	18,431	120,988
Germany	24,924	303,283
Netherlands	26,830	79,834
Czecho-Slovakia	1,443	24,858
Other countries	54	8,575
Totals	126,924	695,166
Patent fuel:		
Great Britain	9,102	33,335
Belgium	26,764	120,800
Germany	3,880	44,521
Other countries	2,030	4,748
Totals	41,776	203,404

EXPORTS

Coal	March	Three Months
Belgium and Luxemburg	242,912	477,099
Switzerland	33,688	61,382
Spain	475	475
Italy	2,274	43,310
Germany	.....	39,349
Other countries	10,982	42,943
Bunkers { French steamers	8,516	35,877
Bunkers { Foreign steamers	3,127	10,329
Totals	301,974	710,764
Coke		
Switzerland	8,526	17,534
Belgium and Luxemburg	308	1,678
Spain	302	720
Italy	14,810	62,522
Germany	.....	1,560
Other countries	493	4,209
Totals	24,439	88,223
Patent fuel		
Switzerland	22,078	42,988
Belgium and Luxemburg	387	4,942
Italy	113	6,835
Other countries	2,246	19,619
Bunkers { French steamers	350	1,726
Bunkers { Foreign steamers	17	110
Totals	25,191	76,220

Hampton Roads Pier Situation

N. & W. piers, Lamberts Pt.:	May 3	May 10
Cars on hand	1,178	828
Tons on hand	76,049	51,724
Tons dumped for week	89,758	113,678
Tonnage waiting	.....	16,000
Virginian Ry. piers, Sewalls Pt.:		
Cars on hand	1,641	1,509
Tons on hand	94,660	87,130
Tons dumped for week	126,152	132,741
Tonnage waiting	10,500	38,100
C. & O. piers, Newport News:		
Cars on hand	1,927	2,096
Tons on hand	101,900	108,525
Tons dumped for week	101,297	74,119
Tonnage waiting	13,185	5,250

Pier and Bunker Prices, Gross Tons

PIERS

	May 5	May 12†
Pool 9, New York	$5.75@$6.25	*$5.75@$6.00*
Pool 10, New York	5.20@ 5.70	*4.90@ 5.60*
Pool 11, New York	4.25@ 5.00	*4.00@ 4.75*
Pool 9, Philadelphia	6.20@ 6.70	*6.15@ 6.60*
Pool 10, Philadelphia	5.25@ 5.65	*5.20@ 5.60*
Pool 11, Philadelphia	4.20@ 4.65	*4.20@ 4.60*
Pool 1, Hamp. Roads	6.25@ 6.50	**7.00**
Pools 5-6-7, Hamp. Rds.	5.50	5.50
Pool 2, Hamp. Roads	6.25@ 6.50	**6.75**

BUNKERS

Pool 9, New York	6.05@ 6.55	*6.05@ 6.30*
Pool 10, New York	5.50@ 6.00	*5.20@ 5.80*
Pool 11, New York	4.55@ 5.30	*4.30@ 5.05*
Pool 9, Philadelphia	6.60@ 6.75	*6.50@ 6.70*
Pool 10, Philadelphia	5.50@ 6.00	*5.40@ 6.00*
Pool 11, Philadelphia	4.50@ 5.00	4.50@ 5.00
Pool 1, Hamp. Roads	6.50	**7.00**
Pool 2, Hamp. Roads	6.50	**6.75**

Current Quotations British Coal f.o.b. Port, Gross Tons

Quotations, by Cable to *Coal Age*

	May 5	May 12†
Admiralty, large	38s.@40s.	**39s.@40s.**
Steam, smalls	26s.@30s.	**30s.**
Newcastle:		
Best steams	34s.6d.@35s.	*34s.@35s.*
Best gas	33s.@35s	*32s.6d.@35s.*
Best bunkers	34s.@36s.	**35s.@35s.6d**

† Advances over previous week shown in **heavy type**; declines in *italics*.

News Items From Field and Trade

ALASKA

The Alaska Legislature has taken action which will permit the territorial government **to co-operate with the U. S. Bureau of Mines in the maintenance of a mine-inspection system.** Under this arrangement B. D. Stewart will be mine inspector for the territory and supervising mining engineer for the Bureau of Mines, as well as the representative of the Secretary of the Interior in matters pertaining to leasing. The proposal to establish an Alaska Mining Development Board was defeated by one vote. The purpose of this board was to devise means whereby the mineral development of the territory could be stimulated. The bill carried an appropriation of $40,000.

ILLINOIS

The Pennsylvania Crusher Co., of Philadelphia, has opened an office in the Monadnock Building, Chicago, with C. S. Darling in charge.

The Illinois Mining Institute will hold its summer meeting on one of the Eagle boats, leaving St. Louis on the morning of Thursday, June 7, and cruising up the Illinois River to Starved Rock, near La Salle, Ill. The boat will return to St. Louis, arriving there about noon on Saturday, June 9.

Arrangements are being made to hold **an Illinois first-aid contest at Collinsville** on Saturday, June 23. The local arrangements are being taken care of by a committee of residents of that city, composed of two operators, two miners and three members of the Civic Association.

Sinking of the new Nason mine in Jefferson county has begun at last. Late in April work started on both the main shaft and the air shaft.

Donk Bros. Coal & Coke Co. is erecting one of the largest tipples in the state at Mine No. 4, near Edwardsville, Ill. The airshaft has been hoisting coal for two years and now the main shaft is about ready. The tipple will be wide enough for six tracks and will have a capacity of 6,000 to 8,000 tons of coal daily. It will be 85 ft. in height. The company also will install one 750-kw. and one 1,000-kw. turbine generators. Electric current will be supplied to the mine at Maryville as well as No. 4 mine.

The Chicago Collieries Co. will sink a mine three miles north of Catlin, near Danville. The shaft will be near the present workings, where a vast amount of coal is being stripped. The company controls 2,800 acres of land lying between the Kistler hill, west of Batestown, and the village of Catlin. At present the big shovels are stripping coal south of the hill and it is planned to sink the shaft at a point further south, which will give employment to more than 300 men. Railroad connections will be made with the Wabash at Catlin and with the Big Four and Illinois Traction System west of Danville.

INDIANA

The Akin-Burton Coal Co. is the name of a newly organized company in Terre Haute. The company will do a general mining business and has a capital stock of $50,000. The organizers are Charles T. Akin, Sedgwick R. Akin and Charles R. Burton.

The Glendale Coal Co., of Terre Haute, has filed a preliminary certificate of dissolution, as did the **Home Coal Co.** of the same city.

For the purpose of dealing in coal lands and leases, the **Bertelsen Coal Co.** has been organized in Evansville with a capital stock of $10,000. The organizers of the company are Jeppe Bertelsen, Katherine Bertelsen and Lowry Bertelsen.

The **Williams Coal Co.** has been organized in Evansville, with a capital stock of $200,000 to own and dispose of mine workings and mining grounds. The organizers are Robert R. Williams, Joseph Wastjer and William W. Gray.

Jos. W. Hays is just completing the organization of a corps of consulting combustion engineers to be known as Jos. W. Hays and Associates. The headquarters of the organization will be Michigan City.

Le Noir Coal Co. has changed its domicile from Terre Haute to Indianapolis, and created $150,000 of preferred stock.

The McDonald Block Coal & Clay Co. has been incorporated at Terre Haute; capital, $50,000; directors, Henry F. McDonald, Jesse W. McDonald, J. C. Coleman, Theodore S. Biggs, Harley McDonald, Fred Hermeling and Harold H. McDonald.

A committee representing the Indianapolis Federation of Community Civic Clubs will confer with officials of the Citizens Gas Co., of that city, in an endeavor **to induce the company to sell its coke direct to consumers.** The coke is now sold, it is claimed, to a Cincinnati jobber, acting as sales agent, who sells it to Indianapolis retail dealers. The gas company produces enough coke to supply every household in Indianapolis.

At the initial session for May of the Vigo County, Ind., Board of Mine Examiners, **permits to work with qualified miners were granted to 27 persons and certificates of qualification were issued to 23.** The board of examiners is composed of George H. Richards, Squire J. Carithers and George Stilwell. Due to scarcity of mine work at the present time the number of applicants is said to be smaller than the average.

IOWA

The Anderson mine, near Knoxville, Iowa, has been abandoned after 15 years' operation. Recently the mine began to fail and last week the machinery was pulled out. At one time over 100 miners were employed and a miners' train was operated between Knoxville and the mine.

J. A. J. Powers, of Knoxville, **has purchased 502 acres of coal land in Monroe County**, near Lovilia, where a stope mine has been in operation on the land for several years. Connections will be made with the Chicago & Northwestern R.R.

The Elmyra Coal Co., of Kansas City, has been incorporated under the Missouri law, with a capital of $40,000.

Tests made in Cedar township and Orange township, near Albia, **show a vein of coal at a depth ranging from 150 to 600 ft.** below the surface. Ten test holes have been sunk and it is expected to complete the tests by July 1. If the coal deposits prove as good as are now indicated a local mining company will be incorporated to operate the mine.

KENTUCKY

The following coal companies were recently incorporated: **Burclut Coal Co.**, Bell; capital, $30,000; incorporators, J. W. Burnett, W. L. Burnett, G. A. Clutts and A. E. Clutts, all of Middlesboro. **Doward Manning Coal Co.**, Jefferson; capital, $24,000; C. P. Downard and Elmore Manning, Louisville, and A. A. Deuser, New Albany, Ind.

The Elkhorn Coal Corporation has resumed dividend payments on its preferred stock by the declaration of a payment of 75c. a share payable on June 11 next to stockholders of June 1. From 1916 until December last year the company had paid dividends regularly at the annual rate of $3 a share on the preferred stock, but in February this year the action on the dividend was deferred. At the time the reason for the action was said to be conditions in the coal industry.

MASSACHUSETTS

James J. Phelan, State Fuel Commissioner, in his final report filed on May 5, **recommends that Massachusetts continue the use of substitutes** for anthracite, and consumers wherever possible should have their winter coal delivered during the summer.

Clinton S. Marshall, general manager of the Worcester division of the American Steel & Wire Co., has announced that because of the high cost of coal that plant will substitute electricity for power. The concern will continue to use coal for its heating plants, but will purchase power.

MINNESOTA

J. H. Bell, one of the largest stockholders of the Carnegie Fuel Co., and **J. N. Stonerood**, both of Pittsburgh and on the company's directorate, inspected the docks of the company at Duluth, May 1. Mr. Bell said that the docks had never been so bare of coal in their history and that he took a pessimistic view of the anthracite outlook. His company, he said, would accept no large contracts for anthracite and would supply the retail trade to a large extent.

MISSOURI

Thomas Wood of Centerville, Ia., has **leased 2,000 acres of land west of the Kirksville** city reservoir and extending to large leaseholds held by another Iowa firm in the same district. Wood will develop the field and will sink a mine.

The Big Creek Coal Co., of Kirksville, Mo., has announced that it **will install machines in its mines** there and has reached an agreement with the miners on a machine scale, as a result of which there should be a marked decrease in the price of coal in Kirksville next winter. According to officials of the company coal mined in this manner will cost about $5 or $5.25 a ton next fall, while this same coal was selling for $7 a ton last winter.

NEW YORK

E. J. Leonard, of Syracuse, has been awarded the contract for furnishing and delivering 3,000 tons of bituminous coal to the Onondaga Sanitorium. The awarding of contract for delivering 2,000 tons of similar coal to the County Home at Syracuse was deferred.

In keeping with the program mapped out by the Association of Railway Executives in their meeting in New York last month **the Erie RR. has been storing coal steadily**, Frederick S. Underwood, president, said recently. "We now have a supply of thirty-six days' coal on hand, and by Sept. 1 will have stored up a supply for ninety days. The Erie's shops have now brought the road's locomotive equipment up to normal, bad-order locomotives averaging about 15 per cent of the total on line, and by Oct. 1 it is expected that freight cars awaiting repairs will be reduced to 5 per cent of the total on line."

OHIO

The following coal companies were recently chartered: **The Webster Coal & Iron Co.**, Dayton; capital, $10,000; incorporators: Oscar Blum, Joseph Eselafsky, Esther Eselafsky, Bessie Blum and Maurice M. Linder. **The Blowers Coal Co.**, Bellaire, $200,000; George A. Blowers, M. M. Weinstein, C. H. Poole, A. E. Clark and D. B. Brooks. **The Nelsonville Consolidated Coal Co.**, Nelsonville; $25,000; D. H. Armstrong, R. S. Oxley, D. F. Shafer, A. H. Schory and O. P. Amann. **The Commercial Coal & Coke Co.**, Cleveland; capital, $10,000; Frederick L. Leckie, Tracy H. Duncan, Theo. C. Robinson, Lee C. Hinslea and Joseph A. Schlitz. **The Euga Coal Mining Co.**, New Lexington; capital, $5,000; J. A. Curtis, R. F. Roberts, M. Herstam and E. Holwick.

The Bingham Coal Co., Cadiz, has been incorporated with a capital of $250,000 to mine and sell coal in the eastern Ohio field. Incorporators are: Charles W. Wenner, F. J. Reese, A. H. Finnical, R. L. Timmons and Albert Wagoner.

The L. & L. Coal Co., of Bellaire, has been chartered with capital of $10,000 by W. J. McGraw, Joe Hodge, Paul V. Waddell, and James O. Wagoner, to mine and deal in coal and coke at wholesale and retail.

H. K. Keyser has succeeded O. M. Richardson as manager for the Old Dominion Coal Co.

Engineers have begun preliminary work for **construction of a fifty-one coke oven unit and byproducts plant** for the Trumbull Cliffs Furnace Co. at Warren. Construction will cost $3,000,000.

J. W. Johns, chairman of the nomination committee of the American Wholesale Coal Association, has asked that the preferences of the members be forwarded to him in

care of the Atlas Fuel Corporation, of Pittsburgh, as soon as possible, so that it may be known who has been settled upon for election as officers when the organization meets in Cincinnati, June 11 and 12. **Charles L. Dearing has been asked by President Morton to act as toastmaster at the annual banquet.**

The Columbus Board of Education has settled its coal problem for the coming year by purchasing 12,000 tons of mine-run Hocking coal from the Colonial Coal Co., of Columbus, at $4.29 delivered. This is a saving of approximately $20,000 over last year when 1¼-in. lump was purchased at $6.19. Bids on mine-run which were opened May 7 ranged from $4.29 to $5.79 per ton delivered to the various school buildings.

PENNSYLVANIA

Senator Joseph O. Clark, Indiana, May 7, introduced a series of four bills relating to the mining laws of the State. One of these amends an act of 1921 relating to anthracite mine inspectors and relieves the inspectors from furnishing bond to the commonwealth. Another amends an act of 1911 relating to bituminous inspectors, relieving them of furnishing the bond. Two other Clark bills amend the same laws, one making a change in respect to Anthracite Mine Inspectors' Examining Board which under the act of 1921 could not sit more than forty days. This limit is removed by an amendment and the Chief of Mines is given the right to determine from time to time the maximum number of days for which the members of the board shall receive compensation. A minor change is the elimination of the requirement that the board's clerk shall also be a stenographer. The Bituminous Mine Inspectors' Examining Board under the act of 1911 was not restricted as to the number of days it could sit, but the Clark amendment provides that the Chief of Mines shall have the same right given him under the anthracite board bill amendment to fix the maximum number of days.

A bill offered by Asa K. DeWitt, Luzerne, provides for approved electric motors and requires attendants at ventilating fans in anthracite mines. The measure prohibits one year after the passage of the bill the use in any anthracite mine of electric motors in which locked safety lamps are used, unless they bear the approval plate of the U. S. Bureau of Mines and have also been approved by the Chief of Mines of Pennsylvania. An attendant must be constantly at fans used to supply air to underground workings and he shall regulate the speed of the fan according to the instructions of the mine foreman. Violators of the measure are subject to a fine of $100 to $200 or two months' imprisonment, or both.

Following an experiment in the **use of carbonic-acid gas in an attempt to extinguish mine fires,** a group of scientists headed by Dr. W. A. Hamor, assistant director of the Mellon Institute of Research at Pittsburgh on May 10 entered the Bitner coal mine of the H. C. Frick Co., near Connellsville, which has burned continuously since November, 1922. **A partial exploration of the burned underground area failed to disclose any fire** in the coal seams that have housed a roaring furnace for six months.

Agreements have been filed in the Dauphin County Court **withdrawing three appeals involving the state anthracite tax.** They were in the cases of the Kingston Coal Co., the Lehigh & Wilkes-Barre Coal Co. and the Spencer Coal Co. The appeals were dropped pursuant to an agreement that they would be withdrawn if the Supreme Court sustained the decision of the lower court in the test case of the Thomas Colliery Co. State coal taxes involved and now payable to the State aggregate $11,807.57.

The Amend Coal Co., of Greensburg, has contracted with the Roberts & Schaefer Co. for the installation of a Marcus screen in its tipple at Newcomer.

A delegation of twenty-five Senators and several bituminous operators on May 8 called upon Governor Pinchot to **urge him to favor an amendment to the administrative code by which the Department of Mines would be retained.** The code makes the department a bureau in the Department of Labor and Industry and the Senators told the Governor they believed that the mining industry and mine workers would be better protected if the present plan is continued. Governor Pinchot said he had not changed his mind relative to the advisability of creating a bureau for the regulation of mining, but that he would take the matter under advisement.

State charters have been issued at Harrisburg for the following bituminous companies: **Little Alps Coal Co.,** Newell; capital stock, $25,000; treasurer, A. M. Speers, Belle Vernon. Incorporators: C. O. Downer, Newell; S. M. Speers, Belle Vernon, and Arthur Hawthorne, Monessen. Purpose: Mining and preparing coal for the market. **Argentine Coal Mining Co.,** Pittsburgh; capital, $300,000; treasurer, E. A. Morris, 2023 Wendover street, Pittsburgh. Incorporators: E. A. Morris and R. M. Carpenter, Pittsburgh, and Will R. Crowthers, Mt. Lebanon. Purpose: Mining coal and buying, selling and dealing in coal lands.

Union workers in the Jermyn colliery of the D. & H. Co. at Jermyn **are preparing to make a membership drive** among the employees at that mine before declaring a button strike. This action was decided upon at a meeting which was addressed by District President William J. Brennan, who advised the men to first conduct a drive to affiliate all employees with the organization before calling a strike.

Fire of unknown origin on April 20 totally **destroyed the washery of the Susquehanna Collieries Co.** at Nanticoke, causing a property loss of approximately $150,000 and causing idleness of sixty employees. The structure, which was one of the largest washeries in the anthracite region, was situated near the site of No. 7 colliery of the Susquehanna company, which was destroyed by fire on Feb. 6.

The Berwind-White Coal Mining Co. presented a petition to the Somerset County Court on May 10 asking for a rule to show cause why an attachment should not be issued for Powers Hapgood, Joseph Foster and John Brozzini, organizers of the United Mine Workers, for contempt of court for alleged violation of the strike injunction granted a year ago. A rule was issued by Judge John A. Berkey and made returnable at Somerset May 21. It is alleged by the coal company that the defendants stopped working miners of the Berwind-White company on their way to work in Windber during the last few days. The petition sets forth that the defendants told the miners that the company's mines were a prison and workmen were not Americans unless they joined the strikers.

After a four-day hearing on a petition to make permanent the receivership of the Von Storch Collieries Co., of Scranton, **Federal Judge C. B. Witmer dismissed George R. McLean,** of Wilkes-Barre, **as temporary receiver** and directed that Edmund B. Jermyn, Scranton coal operator, be elected a member of the company's board of directors. Judge Witmer said that **Mr. Jermyn would represent the court as referee** and that no other order would be made at this time. He added that he hoped the "warring interests" of the company would agree, and if they could not he would direct that an answer be filed to the plaintiff's bill of particulars and appoint a permanent receiver to wind up the concern's affairs, if necessary. Mr. McLean was appointed receiver last week at the request of Henry E. Meeker, of New York, owner of 40 per cent of the company's stock. Mr. Meeker also filed the petition for a permanent receiver.

W. P. Boland, an independent coal operator of Scranton, **has offered the officials of Wilkes-Barre a flat rate of $1 for every ton of coal mined from under the river common.** Two other offers of something like 47c. and 52c. per ton were received, but the identities of those making the tenders were not divulged. It is estimated there are at least 1,000,000 tons of coal under the common.

Members of the United Mine Workers in the anthracite fields have been asked to contribute to a fund of between $75,000 and $80,000, which is being raised to pay for the John Mitchell memorial monument to be erected in Scranton.

After being idle for five weeks, **350 miners employed at the Mount Lookout colliery** of the Temple Coal Co. at Wyoming **are back at work.** Their strike was ended by the company's promise to furnish places for forty men previously laid off because of a squeeze in an underground tunnel. The strike was one of the longest affecting a single colliery in recent years.

W. P. Jennings, general superintendent of the Pennsylvania Coal Co., **entertained the executive force** of the Underwood colliery, located at Throop, at a dinner recently at the Scranton club to celebrate the record made by the colliery in preparing and shipping 10,000 tons of coal in one working day of eight hours. It is believed that this is the record for any colliery in the anthracite region.

H. C. McIlveen, formerly with the Phelps-Dodge Corporation, Clifton, Ariz., is now connected with the engineering department of the Hillman Coal & Coke Corporation, of Pittsburgh.

Twelve additional ovens have been rebuilt by the Corrado Coke Co. at the old Nellie plant near Vanderbilt, making a total of 56 now in blast. Eighty-seven ovens are burning at the Clarissa plant of the same company.

The bituminous coal tax bill of Representative Kohler was **recommitted to the House** Ways and Means committee for a hearing on May 1. The bill provides for a 1½ per cent tax on soft coal, providing for a tax similar to the anthracite tax law.

The plant of the American Briquet Co. near Lykens was destroyed by fire on May 7. The loss is estimated at about $400,000. The plant produced an average of 8,000 tons monthly and gave employment to 55 men.

Notice of a change of corporate name has been filed by the **Berge-Fraser Co.,** Lackawanna County, which will be known as the **Berge Coal Co.**

A charter was issued recently to the **Irwin Valley Coal Co.,** Philadelphia, with a capital stock of $10,000. Warren W. Rush, of Melrose Park, is treasurer. The purpose of the company is mining and preparing coal for the market. The incorporators are William H. Shuster, Wayne; Warren W. Rush, Melrose Park, and George H. Detweiler, Tutledge. Another company incorporated was the **Provins-Ainsley Coal Co.,** Masontown, $10,000 capital H. Gilmore Provins, Masontown, treasurer. Purpose, mining coal and manufacturing coke. Incorporators: George P. Cox, Brownsville; H. Gilmore Provins, Masontown, and James Ainsley, Masontown.

The Fairmont Mining Machinery Co., Fairmont, W. Va., has been awarded the contract **to install new shaker screen tipple equipment for the Bertha-Consumers Co.,** at its Gould Mine, Wilson, on the Peters Creek branch of the Monongahela division of the Pennsylvania R.R.

The Crawford Machinery Co., of Pittsburgh, has removed from the House Building to 1117 Bessemer Building.

Henderson Steele, of Uniontown, has been **appointed ancillary receiver of the Southern Connellsville Coke Co.** by Judge R. M. Gibson in the U. S. District Court at Pittsburgh. The company has a branch office at Cheat Haven, Fayette County. The appointment was made on the petition of George W. Thompson, of Connellsville, a stockholder of the company, in which it was averred that on March 1, 1923 Judge Baker in the U. S. District Court of the northern district of West Virginia, appointed J. H. McDermott, of Morgantown, W. Va., receiver for the company.

A corps of engineers attached to the **Western Maryland Ry.** are located at Meyersdale and, it is reported, **will survey a branch line** from that place to **Jennings, Md.,** with a view of tapping rich coal deposits in southern Somerset County and northern Garret County, Maryland.

A state charter has been issued for the **Cherry Valley Anthracite Mining Corporation,** of Mildred. Its capital stock is $5,000 and Joseph P. Murray, 921 South Fiftieth Street, Philadelphia, is the treasurer. The treasurer, Frank S. Muzzly, 7320 Bryan Street, Mt. Airy, and F. Stanley Saurman, Churchville, are the incorporators.

The Sober Coal Mining Co. has been incorporated in Delaware with a capital of $50,000 by James Sober, Washington, Pa.; J. L. Brenner, J. M. Brenner, Pittsburgh.

The Glen Alden Coal Co. has purchased the Exeter Machine Co. works and property at West Pittston. The deal is said to have involved an outlay of $500,000. W. W. Inglis, president of the Glen Alden Coal Co., stated that the company does not contemplate immediately to operate the plant, but made the purchase for emergency purposes to provide a suitable machine shop for the manufacture and repair of breaker and mine machinery for its use when deemed advisable to take over operation of the shop.

Herbert Lloyd, president of **The Electric Storage Battery Co.,** Philadelphia, **has announced a plan by which employees** who have been continuously in the service of the company for two years or more **may become stockholders in the company.** The plan permits employees to purchase one share of common stock of the company at $53 per share for each $500 of his or her annual compensation, but not exceeding 20 shares to any one employee.

The Link-Belt Co. has removed its **Pittsburgh branch office** from 1501 Park Building to new and more commodious offices at 335 Fifth Avenue. T. F. Webster, manager of the Pittsburgh office, says that larger space and the more convenient location was imperative because of the large volume of business transacted during the past year and which promises to continue during the coming fiscal year.

A state charter has been issued at Harrisburg for the **Amy Coal Co.**, Philadelphia, the purpose of which will be to mine and deal in coal and coal lands. The company has a capital stock of $500,000 and its incorporators are Harry E. Bird, treasurer, Fifteenth and Market Streets, Philadelphia; John Barnes, Haverford, and E. L. Clarks, Cheltenham.

The following bituminous coal companies have been incorporated: **Brooks Coal Co.**, Normalville, capital $20,000; J. C. Henry, Connellsville, treasurer. He, with C. H. Brooks and Carl C. Brooks, Normalville, are the incorporators. **Nicewonger Coal Co.**, Greensburg, $25,000; Vance E. Booher, 140 North Main Street, Greensburg, treasurer. The incorporators are Lewis Nicewonger, Luxor; Hallis E. Nicewonger, Greensburg, and John H. McElveen, Greensburg. Both companies will mine coal and manufacture coke and byproducts.

SOUTH CAROLINA

Sealed proposals will be opened by the Superintendent of Lighthouses, Charleston, at noon, May 25, 1923, for approximately **4,000 tons of steam coal** (bituminous) and **175 tons stove coal** (anthracite), as required during the fiscal year 1924, delivered at Charleston. Information upon application.

WEST VIRGINIA

Output of the Island Creek Coal Co. in April amounted to 204,000 tons and brought the four months' total up to 830,000 tons, compared with 1,348,000 tons in the first four months of 1922. The four months' earnings were approximately $7.50 a share, or within 50c. of the yearly $8 dividend requirement.

A fire completely wiped out the town of Burke, McDowell county, 25 miles west of Bluefield, April 20, rendering more than a thousand persons homeless and destroying property valued at a million dollars. The fire was checked after it had spread to the adjoining village of Keystone and had destroyed three buildings there. More than 100 buildings in Burke were burned, including 25 cottages belonging to the Houston Coal & Coke Co.

J. W. Swanner and Edward Reynolds, West Virginia miners, **were shot and killed** at the mining camp of Vulcan, near Pomeroy, May 9, by J. E. Miller, a coal miner. Miller gave as his reason that he feared the two men had come to kidnap him and take him back to West Virginia in connection with the Logan armed march. That the killing of Swanner and Reynolds, witnesses for the state in the cases against C. F. Keeney and others for complicity in the murder of Logan County deputy sheriffs, was a part of a plot is charged by A. M. Belcher, of counsel for the state, and the charge is also made by L. Crary Davis, prosecuting attorney of Meigs County, that the killing of the two witnesses was cold-blooded murder. Swanner had in his pocket a letter from A. M. Belcher offering Miller immunity if the latter would return to West Virginia to testify in the armed march trials.

The Sanfield Coal Co., of Fairmont, has been organized with a capital stock of $1,700,000 for the purpose of operating in northern West Virginia. The size of the capital stock presages operations on a large scale. Heavily interested in the new company are M. W. Ogden, C. F. Crane, M. C. Lough and A. C. Lyons, of Fairmont; Harry E. Davisson and James G. Kidwell, of Clarksburg.

The King Fuel Co. expected to begin the production and shipment of coal about May 1, after two years preparation in constructing a modern plant not far from Christian, near the dividing line between Mingo and Wyoming counties.

Charters were granted recently to the following coal companies: **Appalachian Fuel Co.**, Fairmont; capital, $50,000; incorporators, Harvey H. Staggers, Mabel F. Staggers, Dan R. Lawson, Edith A. Lawson and E. A. Russell, all of Fairmont. **White Rose Coal Co.**, Shinnston; capital, $75,000; incorporators, Irvin Smith, H. J. Wagner, George Beck, William Beck, Smithton, Pa., and John Parachino, Greensburg, Pa. **Preston Smokeless Coal Co.**, Fairmont; capital, $75,000; incorporators, J. S. Mallory, Gertrude W. Mallory, Shinnston, W. Va.; H. S. Keister, Toyie A. Keister and M. B. Simonds, Fairmont.

The G. E. Burgess Coal Co. will operate in the neighborhood of Sand Run on the Charleston Division of the Baltimore & Ohio R.R., having just been organized with a capital stock of $10,000. Organizers of the new concern include G. E. Burgess, D. F. Fenney, D. F. Bearus, of Sand Run; Ray Jones and L. W. Jones, of Elk Garden.

A number of the smaller mines along the line of the Baltimore & Ohio in northern West Virginia are closing down because of low prices and lack of orders.

Five West Virginia coal companies have surrendered their charters and discontinued business. They are the Wanego White Ash Coal Co., Big Clear Creek Coal & Land Co., Carmen-Litten Coal Co., the Ritter Coal Co. and the Aileen Coal Co.

The tipple and bin at Mine No. 7 of the **Carbon Fuel Co.** on Cabin Creek, in the Kanawha field, having been destroyed by fire about two years ago, **a new tipple and bin has been in process of construction** embodying many improvements. Work on the new structure is nearing completion and the company will be able in a short time to use the new equipment which was installed by the Kanawha Manufacturing Co., of Charleston, at a cost of about $60,000.

The power house of the Hutchinson Coal Co., near Mason City in Mason County, **was destroyed by fire** a few weeks ago. There is a difference of opinion as to what caused the fire, one report received being to the effect that it was as a result of an overheated smokestack, and one to the effect that it was of incendiary origin.

WASHINGTON, D. C.

The Interstate Commerce Commission announces **the resignation of Robert E. Quirk as chief examiner**, effective June 15. He is to be succeeded by Ulysses Butler, formerly assistant chief examiner, who will in turn be succeeded by Charles F. Gerry, who has been an attorney-examiner for the commission.

Frank McManamy, of Washington, D. C., has been appointed a member of the Interstate Commerce Commission to succeed W. W. Daniels, of New Jersey, resigned to become professor of transportation at Yale University. Mr. McManamy is the labor representative on the Commission. He is 53 years old and has been connected with the I. C. C. and the Railroad Administration for 15 years. Prior to entering the government service he was a railroad worker.

A paper on "The Origin and Destination Weighing of Coal in Carload Lots" will be delivered during the course of the sixteenth annual conference on weights and measures which will be held at the Bureau of Standards in Washington May 21 to May 24. Another paper is entitled **"Retail Sales of Coal and Coke."**

CANADA

The Denver Rock Drill Mfg. Co., of Denver, Col., has discontinued its branch at Toronto and has established **a new branch at Montreal.**

Jung Low, a Chinese miner, was responsible for the explosion in No. 4 mine of the Canadian Collieries at Cumberland, Feb. 8 last, that cost the lives of Jung and 32 other miners, according to the report of an investigation of the disaster made by George Wilkinson, official investigator for the government. According to Mr. Wilkinson evidence obtained indicated that while working in the mine Jung attempted to light a cigarette, when the charged atmosphere exploded and burst into flames.

Thomas G. Shiels, of the Elias Rogers Co., Toronto, told the Commons committee investigating the fuel situation that last summer he had brought in a carload of **Alberta anthracite and had found that it in no way compared with American anthracite.**

The Toronto Wholesale Coal Dealers Association is making arrangements to send a large delegation to the annual convention of the American Wholesale Coal Association in Cincinnati on June 12 and 13.

The British Empire Steel Corporation reports coal production for the first four months of the year of 1,851,954 gross tons, as compared with an output of 1,074,045 gross tons during the corresponding period

The Vancouver city council has denied the application of a local syndicate, asking **for right of entry into Stanley Park** for the purpose of developing a seam of coal that has been found on the shore of the park.

The Mount Cavel Collieries, Ltd., of Edmonton, Alta., has been incorporated to acquire and operate mines in Jasper Park, Alta., with an authorized capital of $200,000, by Samuel L. Crocker, Samuel R. Wallace, H. McCoy and others.

Alexander Howat, deposed Kansas District president of the United Mine Workers of America, who was detained at McAdam Junction, N. B., by the Canadian immigration authorities while on his way to address the coal miners in Cape Breton, which detention was later affirmed by the Department of Immigration at Ottawa, has left Houlton, Me., for New York, according to a newspaper dispatch. "The action of the Canadian authorities in denying me admission to the country is an outrage," Howat said before leaving. "If I am stopped any other working man can be refused admission when there is no just cause."

W. F. Carroll, chairman of the House of Commons Committee investigating the coal supply, states that **English capitalists are prepared to open up and operate undeveloped coal areas at Mabou**, on the western coast of Cape Breton, if the government will facilitate transportation by providing railway extensions. The area has the advantage of possessing a harbor much closer to Montreal than Sydney or Louisburg. A representative of the British interests concerned is now in Canada and prepared to go ahead with the project.

An agreement has been completed between operators of coal mines in the Grand Lake district of New Brunswick and the Canadian National Railways, under which **much larger quantities of coal from the Minto mines will be used by the railways** during the coming year than ever before. Details of contracts calling for the tripling of the tonnage for the year have been arranged. Construction of a new spur line five miles in length to connect Minto with the Canadian National Railways at Chipman also is planned.

Obituary

E. L. Stafford, superintendent of the Carlswell shafts of the Houston Collieries Co., Carlswell, W. Va., died suddenly on May 2.

Joseph Reese, who for more than 20 years had been superintendent of the Temple Coal Co. at Blakely, Pa., died on May 5. Mr. Reese was 68 years old. He was placed on the retired list a few years ago.

John Irwin, 84 years old, the first H. C. Frick Coke Co. pensioner, died at his home in Connellsville, Pa., on April 29. He had been in the employ of the H. C. Frick Coke Co. 27 years at the time he was placed on the retired list.

William H. Reynolds, well known to a large number of friends in the Pittsburgh district as a miner and writer of mining life and experiences, died at his home, Butler, Pa., April 24, 1923, following an operation for appendicitis, at the early age of 47 years. Mr. Reynolds is best known and will be long remembered by many who have read with deep interest his book entitled "In the Carbon Hills." It is a true picture of mining life, filled with pathos and humor. Mr. Reynolds is survived by two brothers, J. T. and S. C. Reynolds, both now acting as mine inspectors.

Alexander H. Ross, a member of the firm of A. H. Ross & Co., coal dealers, Newark, N. J., died May 1. He was seventy-four years old. His brother, Robert L. Ross, with whom he was in business, is a former Receiver of Taxes and also was a member of the City Tax Board of Newark. Alexander Ross was born in New York, Sept. 11, 1848. He started in the coal trade fifty-seven years ago as an employee of the Delaware & Hudson Canal Co. In 1889 he organized the Ross concern with his brother. Mr. Ross was not married. Besides his brother, he is survived by a sister, Miss Elizabeth J. Ross.

Trade Literature

"Oswego" Internally Fired Water-Tube Boilers. A. D. Granger Co., New York, N. Y. Bulletin No. 2. Pp. 19; 8 x 10 in.; illustrated. Describes both the type A and type B boilers, the latter having down-draft Hawley type grates. Key tube plates are also featured, the use of which eliminates the gasket joints on the head.

M-S-A Playground Equipment. Mine Safety Appliances Co., Chamber of Commerce Building, Pittsburgh, Pa. pp. 25; 8 x 10 in.; illustrated. This book contains a complete list of outfits for playgrounds. Among some of the apparatus shown are slides, ocean wave, merry-go-round, rocking boat, teeter ladders, swings, and horizontal bars. Information is given as to size and arrangement of playground, surfacing and grading, fencing, lighting, with plan of a typical school playground. The H-H inhalator is shown with description of method of procedure in its use. Price list accompanies the bulletin.

Graver Zeolite Water Softener. Graver Corp., East Chicago, Indiana. Bulletin 509. Pp. 8, 8 x 11 in., illustrated. Describes the effect of the softener on hard water.

Bristol's Recording Gauges for Pressure and Vacuum. The Bristol Co., Waterbury, Conn. Catalog No. 1006. Pp. 83, 8 x 10 in., illustrated. Contains charts showing ranges covered and describes utility of recording gauges, also liquid level gauges, simplicity of construction, with partial list of applications.

Traffic News

The embargo placed by the New York Central R.R. against all freight destined to points on or via the Boston & Maine R.R. was **entirely cancelled May 10.**

The embargo placed by the New York Central R.R. against all freight destined to points on or via the Boston & Albany R.R. was **entirely cancelled May 10.**

An issue of $17,000,000 railroad equipment trust certificates has been authorized by the directors of the New York Central, Michigan Central and the Big Four railroads. Orders for the equipment, costing about $23,000,000, that is to be obtained through the funds from these certificates and cash from the company treasury, have already been placed, it is understood.

In a complaint brought by the Milwaukee-Commerce Commission, **the Tioga Coal Co.,** operating coal mines in the Gauley region of West Virginia, **urges that the Baltimor & Ohio R.R. be instructed to extend to it an adequate daily car-rating allotment,** joint through rates, and rates which are not higher than the "outer crescent" basis of rates to Western points of destination, and rates not more than 15c. per ton over the Fairmont district rates to Eastern points of destination.

S. D. Warriner, president of the **Lehigh & New England R.R.,** in his report for the year ended Dec. 31, 1922, says that the **strike in the anthracite region caused a decrease in the railway operating revenues** from anthracite freight of $565,437.88, as compared with 1921, while revenues from bituminous-coal freight and from merchandise freight show increases of $68,-120.83 and $406,702.38, respectively. Miscellaneous freight carried by the road during 1922 was 6,327,114 net tons of which there was 2,579,470 net tons of anthracite, 1,603,634 net tons of bituminous coal and 23,871 net tons of coke. In 1921 5,943,780 net tons of miscellaneous freight was carried, of which 2,840,356 net tons was anthracite, 1,492,643 net tons bituminous coal and 26,996 net tons coke.

Rates charged on coal in carloads from and to points in Missouri during the federal control of railroads were not unreasonable, in the opinion of I. L. Koch, an Interstate Commerce Commission examiner. In a tentative report on the complaint made by the McGrew Coal Co., of Lexington, Mo., he recommends that the complaint be dismissed. That rates lower than those charged the McGrew company were contemporaneously in effect for greater distances is not held to be a sufficient reason to condemn a rate. The coal company also declared that the rates were violative of the Constitution of the State of Missouri. In that connection the examiner says: "The commission's powers to adjudicate complaints of this nature are derived solely from the transportation and interstate commerce acts. Those laws do not give it jurisdiction to administer either the common law or any state constitution or statute. The standard of reasonableness embodied in the Missouri Constitution is not controlling up this commission.

The valuation set on the Virginian Ry. and its terminals by the Interstate Commerce Commission **will be discussed at a public hearing** to be held in Washington May 23.

The New York Central R.R. issued an embargo May 9 on all freight destined to all points on or via the Central New York Southern R.R., on account of advices from the Central New York Southern R.R. as to inability to operate.

C. E. Tuttle, of the Tuttle Coal Corporation, of New York City, **has been elected a director of the Pittsburgh & West Virginia R.R.** Henry E. Farrell, of Pittsburgh; William R. Nicholson and Asa S. Wing, of Philadelphia, and Ernest Stauffen, Jr., of New York, were re-elected directors. The following executive committee was chosen: William H. Coverdale, John B. Dennis, Henry E. Farrell, Haley Fiske, George P. Smith and Richard Sutro.

The Sewell Valley Ry. is not entitled to a larger proportion of joint rates on coal than it is now receiving from the Chesapeake & Ohio, in the opinion of William B. Hunter, an attorney examiner for the Interstate Commerce Commission. In his report to the commission, Mr. Hunter recommends that the Sewell Valley company's complaint be dismissed. The Sewell Valley company contends that the coal traffic delivered it from the Greenbriar & Eastern must be hauled up a steep ascent of 21 miles, which results in operating expenses which make its share of the joint rate non-compensatory. Mr. Hunter suggests that the Sewell Valley is not suffering from the alleged unremunerative coal traffic from the Greenbriar, but probably from its control in the financial interest of the Meadow River Lumber Co. and the Lookout R.R. and from the fact that it has not been equipped to handle its freight traffic economically.

One of the largest railway electrification projects yet undertaken is involved in the contract just closed by the Westinghouse Electric & Manufacturing Co. with the Virginian Ry. It calls for the electrification of 213 miles of track between Roanoke, Va., and Mullens, W. Va., and includes an order for electric locomotives, power house, transformer stations and other necessary apparatus. The division to be electrified crosses the Alleghany Mountains. The contract involves the expenditure of $15,000,000.

In a complaint bronght by the Milwaukee-Western Fuel Co. the Interstate Commerce Commission decided April 26 that rates were unreasonable on coal, in carloads from the Princess, Kilgore and Norton branch on the Ashland Coal & Iron Ry. to Toledo for transshipment by lake during federal control. A rate of $2.15 a ton was charged. The commission held $1.55 to be a fair rate and ordered reparation with interest paid on rates more than $1.55 a ton.

The Coal, Coke & Iron Ore Committee, Central Freight Association Territory, announces a public hearing at 10 a.m. (daylight-saving time), May 24, at the Chamber of Commerce Building, Pittsburgh, Pa., **to consider the rate on bituminous coal,** carloads, from mines on the Baltimore & Ohio R.R. in the Pittsburgh-Youghiogheny (Connellsville-Finleyville, Pa., etc.), to Cincinnati and Hamilton, Ohio. It is proposed to advance the rate to $2.33 per net ton, to correct a clerical error. At that time also a hearing will be held to consider the **rate on bituminous coal, carloads, to Westerville, Galena and Sunbury, Ohio, via the Pennsylvania R.R.** from mines on the Sandy Valley & Elkhorn, Long Fork and Millers Creek railroads. It is proposed to advance the rate to $2.14 per net ton to remove Fourth Section violation.

The net income of the Pennsylvania Railroad and its affiliated companies in 1922, according to the annual report, was $32,382,058, an increase of $8,074,389.15 when compared with 1921. There were carried over its lines 194,856,802 tons of miscellaneous freight. The value of the anthracite carried over the lines of the company was placed at $12,503,649; bituminous, $108,502,266, and of coke, $10,-356,060. Fuel for yard locomotives cost $9,081,512 and for train locomotives, $41,-060,682, an increase in both items of $6,773,355. The Pennsylvania Lines consist of over 600 constituent transportation corporations, including five coal-land companies and two coal-land companies classed as inactive. Its net railway operating income was $73,405,325.69, a return of 3.72 per cent upon the investment in road and equipment.

Coming Meetings

The American Wholesale Coal Association will hold its annual convention June 12 and 13 at the Gibson Hotel, Cincinnati, Ohio. Secretary, G. H. Merryweather, Union Fuel Bldg., Chicago, Ill.

Illinois and Wisconsin Retail Coal Dealers' Association will hold its annual meeting June 12-14 at Delavan, Wisconsin. Secretary, I. L. Runyan, Great Northern Building, Chicago, Ill.

Southwestern Interstate Coal Operators' Association will hold its annual meeting June 12 at Kansas City, Mo. General Commissioner, W. L. A. Johnson, Kansas City, Mo.

Pennsylvania Retail Coal Merchants' Association will hold its annual meeting May 23 and 24 at Wilmington, Del. Secretary, W. M. Bertolet, Reading, Pa.

American Association of Mechanical Engineers will hold its spring meeting at Montreal, Quebec, Canada, May 28-31. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

New England Coal Dealers' Association will hold its annual meeting at Providence, R. I., June 13-15. Secretary, C. R. Elder, Boston, Mass.

National Retail Coal Merchants' Association will hold its sixth annual convention June 25, 26 and 27 at Scranton, Pa., with headquarters at the Hotel Casey.

National Safety Council will hold its twelfth annual safety convention at the Buffalo Statler Hotel, Buffalo, N. Y., Oct. 1-5. Managing director and secretary, W. H. Cameron, 168 No. Michigan Ave., Chicago, Ill.

International First-Aid and Mine-Rescue meet will be held Aug. 27-29, at Salt Lake City, Utah.

American Institute of Electrical Engineers will hold its annual convention June 25-29, at Swampscott, Mass. Secretary F. L. Hutchinson, 29 West 39th St., New York City.

International Railway Fuel Association will hold its spring convention at the Hotel Winton, Cleveland, Ohio, May 21-24, Secretary-treasurer, J. G. Crawford, Chicago.

American Society for Testing Materials will hold its annual meeting at the Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., beginning June 25 and continuing throughout the week. Secretary, E. Marburg, Philadelphia, Pa.

The Colorado & New Mexico Coal Operators' Association will hold its annual meeting June 20 at Denver, Col. Secretary, F. O. Sandstrom, Denver, Col.

The Electric Power Club's annual meeting will be held at the Homestead, Hot Springs, Va., June 11-14. Executive secretary, S. N. Clarkson, Cleveland, Ohio.

National Coal Association will hold its sixth annual convention June 19-22 at Atlantic City, N. J. Assistant secretary, C. C. Crowe, Washington, D. C.

Michigan-Ohio-Indiana Coal Association will hold its annual convention at the Hotel Sinton, Cincinnati, Ohio, May 22-24. Secretary, B. F. Nigh, Brunson Bldg., Columbus, Ohio.

West Virginia Coal Mining Institute has tentatively set June 5 and 6 for its annual meeting, to be held at Clarksburg, W. Va. Secretary, R. E. Sherwood, Charleston, W. Va.

Retail Coal Dealers' Association of Texas will hold its eighteenth annual convention at Galveston, June 11 and 12. Secretary, C. R. Goldmann, Dallas.

The American Institute of Mining and Metallurgical Engineers has accepted the invitation extended by the Ministers of Mines of Ontario and Quebec and by the Canadian Institute of Mining and Metallurgy to hold its autumn meeting in Canada. The meeting will start Aug. 20 at Toronto and end Aug. 30 at Montreal. Secretary, F. F. Sharpless, 29 West 39th Street, New York City.

The Illinois Mining Institute will hold its summer meeting on board a boat on the Illinois River, cruising between St. Louis, Mo. and La Salle, Ill., June 7-9. Secretary, Martin Bolt, State House, Springfield, Ill.

West Virginia Coal Mining Institute has set June 12 and 13 for its annual meeting, to be held at Hotel Waldo, Clarksburg, W. Va. Secretary, R. E. Sherwood, Charleston, W. Va.